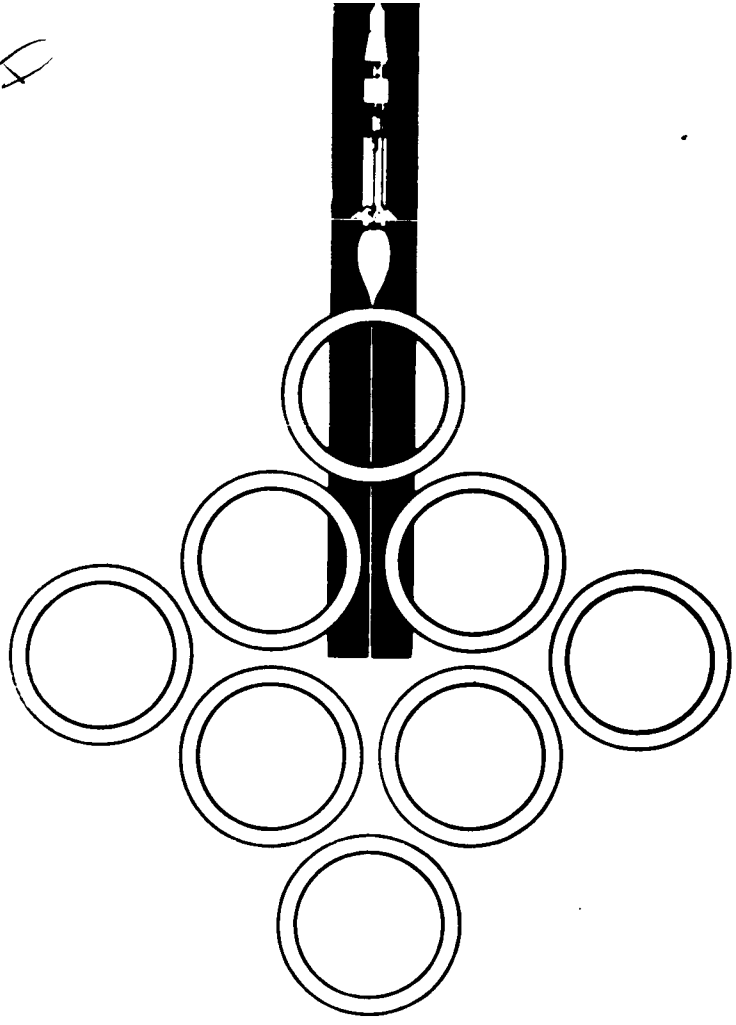

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1128-3

July 11, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

PRESSURE SWITCH

Helicoid Gage Division Part Numbers 4231-1 and 4231-2

NASA Drawing Numbers 10434443-18 and 10434443-6

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

PRESSURE SWITCH

Helicoid Gage Division Part Numbers 4231-1 and 4231-2

NASA Drawing Numbers 10434443-18 and 10434443-6

ABSTRACT

This report presents the results of tests performed on 3 specimens of Pressure Switch 10434443. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Low Temperature
5. High Temperature
6. Humidity
7. Salt Fog
8. Explosion
9. Vibration
10. Cycle
11. Burst Pressure

Specimen 1 would not actuate during the functional test performed prior to the low temperature test. The unit operated properly after the pressure adjustment screw was turned and reset.

The set pressure dial pointer and blowout disc of specimen 1 came loose at 25 cps during the Y-axis sinusoidal search. At 40 cps the plexiglas lens rotated, the nameplate loosened, and the **Micro Switch contact arm bent downward.** "Bottoming" of the specimen occurred at each frequency. A crack occurred in the capillary tubing of specimen 2 during the X-axis vibration tests thereby making the unit inoperative. The shock mounts of specimens 1 and 2 were gouged and cut during the vibration tests. Both units were returned to the vendor for evaluation and reconditioning.

The contact voltage drop of specimen 2 (pins B to C) was out of tolerance after the humidity test and for the remainder of the test program.

The differential pressure ("dead-band") of specimen 3 exceeded the specified limit after the salt fog test.

The actuation pressure of specimen 2 was outside the specified limits after the Z-axis sinusoidal sweep during the vibration retest. At 40 cps during the Z-axis sine sweep, the set pressure dial pointer of specimen 3 came loose. The shock mounts on each of the test specimens were gouged and cut during the vibration tests.

The Micro Switch of specimen 2 operated intermittently between 79 and 84 psig during the cycle test.

TEST REPORT

FOR

PRESSURE SWITCH

Helicoid Gage Division Part Numbers 4231-1 and 4231-2

NASA Drawing Numbers 10434443-18 and 10434443-6

July 11, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

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PRESSURE SWITCH 10434443

CHECK SHEET

FOR

PRESSURE SWITCH

MANUFACTURER: Helicoid Gage Division
MANUFACTURER'S PART NUMBERS: 4231-1 and 4231-2
NASA DRAWING NUMBERS: 10434443-6 and 10434443-18
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA-KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIA:	Gaseous nitrogen, air
B.	OPERATING PRESSURE:	
	1. Actuating Pressure:	4231-2, 625 (±15) psig 4231-1, 100 (±15) psig
	2. Differential Pressure:	4231-2, 55 psi max. 4231-1, 30 psi max.
C.	PROOF PRESSURE:	4231-2, 1200 psig 4231-1, 300 psig
D.	CONTACT RATING:	3-amp resistive load

II. CONSTRUCTION (MECHANICAL)

A.	PRESSURE ELEMENT:	Bourdon tube of K Monel and brass
B.	PNEUMATIC CONNECTION:	Per AND 10050-4
C.	WEIGHT:	2 lb

III. CONSTRUCTION (ELECTRICAL)

A.	CONNECTOR:	MS3102E-14S-7P
B.	CONTACT VOLTAGE DROP:	0.300-volt maximum at rated load

IV. ENVIRONMENTAL CHARACTERISTICS (MANUFACTURER'S SPECIFICATIONS)

TEMPERATURE RANGE:	-40 to +160°F

V. LOCATION AND USE

A.	LOCATION:	Pneumatic Distribution System Panel No. 10
B.	USE:	Closes circuit to enable operation of Solenoid Valve A5194, which controls the flow of GN_2 to the S-IB Stage fuel bubbling line.

TEST SUMMARY

PRESSURE SWITCH 10434443

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	1,2,3	Visual inspection	To determine if specimens conform with applicable drawings and specifications	Unsatisfactory	Incorrectly wired electrical connectors
Proof Pressure Test	1 & 2	300 psig for 5 minutes	Maintain pressure for 5 minutes	Satisfactory	
	3	1200 psig for 5 minutes	Maintain pressure for 5 minutes	Satisfactory	
Initial Functional Test a. Actuation and De-actuation	1 & 2	Actuate at 100 (±15) psig; differential pressure not to exceed 30 psi.	Actuate and de-actuate test specimens within specified levels	Satisfactory	
	3	Actuate at 625 (±15) psig; differential pressure not to exceed 55 psi.		Unsatisfactory	Excessive "dead-band"
b. Contact Voltage	1,2,3	Apply a 3-amp., 28-vdc resistive load across closed contacts	Voltage drop shall not exceed 300 millivolts	Satisfactory	
c. Insulation Resistance	1,2,3	500 vdc applied between non-connected pins and between each pin and switch case	Insulation resistance not less than 20 megohms	Satisfactory	
d. Dielectric Strength	1,2,3	1000 vac (rms), 60 cps applied between non-connected pins and between each pin and switch case	Leakage current not greater than 2 milliamperes	Satisfactory	

TEST SUMMARY (CONTINUED)

PRESSURE SWITCH 10434443

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
d. Random Vibration	2	Vibrate specimen for 5 minutes, increasing the input level until degradation occurs or until a maximum input level of 0.025 g^2/cps is attained	Determine if a vibration environment causes degradation of the test specimen	Unsatisfactory	Crack in capillary tubing
Humidity Test	2 & 3	240 hours of humidity environment; vary temperature from ambient to 160°F to ambient during each 24 hour period, maintaining 95% humidity	Determine if humid environment causes degradation or deterioration of the test specimens	Unsatisfactory	Excessive contact voltage drop in specimen 2
Salt Fog Test	1,2,3	5 percent by weight mixture salt solution; collection rate of 0.5 to 3 milliliters per hour; maintain for 240 hours at 95°F	Determine if salt fog environment causes degradation or deterioration of the specimens	Unsatisfactory	Excessive "dead-band" for specimen 3
Explosion Test	1 & 3	32 percent by volume hydrogen 160°F at 13.1 psig	Operate specimens in explosive atmosphere	Satisfactory	

TEST SUMMARY (CONTINUED)

PRESSURE SWITCH 10434443

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Low Temperature Test	1 & 3	Stabilize at 5°F, perform a functional test and return to ambient conditions	Determine if low temperature environment causes degradation or deterioration	Satisfactory	
High Temperature Test	1 & 3	Stabilize at 160°F, perform a functional test, and return to ambient conditions	Determine if high temperature environment causes degradation or deterioration	Satisfactory	
Vibration Test					
a. Resonant Frequency Search	1 & 2	Vibrate specimens for 15 minutes from 5 to 3000 to 5 cps at 1g peak	Determine resonant frequencies of test specimens	Satisfactory	
b. Sinusoidal Search	1 & 2	Vibrate specimens at 1/3 octave center frequencies; increase input level until degradation occurs or specified maximum level is attained	Determine the highest input level, within specified limits, at which degradation will not occur	Unsatisfactory	Broken Micro Switch in specimen 1
c. Sinusoidal Sweep	2	Vibrate specimen for 15 minutes from 10 to 2000 to 10 cps at specified input levels	Determine if a vibration environment causes degradation of the test specimen	Satisfactory	

TEST SUMMARY (CONTINUED)

PRESSURE SWITCH 10434443

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Vibration Retest					
a. Resonant Frequency Search	1,2,3	Vibrate specimens for 15 minutes from 5 to 3000 to 5 cps at 1g peak	Determine resonant frequencies of test specimens	Satisfactory	
b. Sinusoidal Search	1,2,3	Vibrate specimens at 1/3 octave center frequencies; increase input level until degradation occurs or specified maximum level is attained	Determine the highest input level, within specified limits at which degradation will not occur	Satisfactory	
c. Sinusoidal Sweep	1 & 3 2	Vibrate specimens for 15 minutes from 10 to 2000 to 10 cps at specified input levels	Determine if a vibration environment causes degradation of the test specimens	Satisfactory Unsatisfactory	 Improper actuation pressure
d. Random Vibration	1,2,3	Vibrate specimens for 5 minutes, increasing the input level until degradation occurs or until a maximum input level of 0.025 g^2/cps is attained	Determine if a vibration environment causes degradation of the test specimens	Satisfactory	
Cycle Test	1,2,3	Actuate and deactuate each specimen for 5000 cycles	Determine effect of continuous operation on specimen performance	Satisfactory	

TEST SUMMARY (CONTINUED)

PRESSURE SWITCH 10434443

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Burst Pressure Test	1	425 psig for 5 minutes using hydraulic fluid	Maintain pressure for 5 minutes with no evidence of cracking or rupture	Satisfactory	
	3	1875 psig for 5 minutes using hydraulic fluid		Satisfactory	

SECTION I

INTRODUCTION

1.1 SCOPE

This report presents the results of tests that were performed to determine if Pressure Switch 10434443 meets the operational and environmental requirements of the John F. Kennedy Space Center. A summary of the test results is presented on pages viii through xi.

1.2 ITEM DESCRIPTION

1.2.1 Three specimens of Pressure Switch 10434443 were tested. The switches are manufactured by Helicoid Gage Division as vendor part numbers 4231-1 (specimens 1 and 2) and 4231-2 (specimen 3). Switch 4231-1 operates on increasing pressure at 100 (±15) psig with a differential pressure of 30 psi, maximum. Switch 4231-2 operates on increasing pressure at 625 (±15) psig with a differential pressure of 55 psi, maximum.

1.2.2 The specimens are mounted in a vertical position by three shock mounts which are attached to a base plate. The specimens will be used in a pneumatic distribution system at Launch Complex 34.

1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Pressure Switch 10434443:

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy

b. NASA Drawing 10434443

c. Test Plan CCSD-FO-1128-1R, Revision A

d. Test Procedure TP-RE-CCSD-FO-1127/1128-2R

1.4 SPECIMEN ASSIGNMENT NUMBERS

The specimen assignment numbers are as follows:

Specimen	Manufacturer's Part Number
1	4231-1
2	4231-1
3	4231-2

SECTION II

RECEIVING INSPECTION

2.1 TEST REQUIREMENTS

Each specimen shall be visually and dimensionally inspected for conformance with the applicable specifications prior to testing.

2.2 TEST PROCEDURE

A visual and dimensional inspection was performed to determine compliance with NASA drawing 10434443 and to the applicable vendor drawings, to the extent possible without disassembly of the test specimens. At the same time, each test specimen was also inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

The electrical connectors were not wired according to the wiring diagram in NASA drawing 10434443. The normally open and normally closed contacts were reversed.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimens 1, 2, and 3	Helicoid Gage	4231-1 4231-2	NA	Pressure Switch
2	Nitrogen Supply	NA	NA	NA	3100 psi
3	Pressure Regulator	Tescom Corp.	26-1002	1009	3100 psi
4	Pressure Gage	Martin-Decker	NA	NA	0 to 2000 psig ±0.1% FS Cal date 7-5-67
5	Relief Valve	Robbins	ANA 250-4T	NA	1/4-inch
6	Hand Valve	Robbins	ANA 250-4T	NA	1/4-inch
7	Hand Valve	Robbins	ANA 250-4T	NA	1/4-inch
8	Burst Chamber	CCSD	NA	NA	Burst pressure test only

Table 3-2. Proof Pressure Test Data

Specimen Number	Pressure (psig)	Time (minutes)	Leakage	External Damage
1	300	5	None	None
2	300	5	None	None
3	1200	5	None	None

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 Test specimens 1 and 2 shall be pressurized to 300 psig for 5 minutes, using gaseous nitrogen. Test specimen 3 shall be pressurized to 1200 psig for 5 minutes using gaseous nitrogen.

3.1.2 The test specimens shall be inspected for leakage and external damage.

3.2 TEST PROCEDURE

3.2.1 The test setup was assembled as shown in figure 3-1, using the equipment listed in table 3-1.

3.2.2 Each specimen was pressurized to the rated proof pressure by closing hand valve 5 and adjusting pressure regulator 3.

3.2.3 The specimens were checked for leakage during the 5 minute period by monitoring gage 4 for an indication of a pressure drop at the specimen. The initial and final pressures were recorded.

3.2.4 Pressure regulator 3 was closed and hand valve 5 was opened to depressurize the specimens.

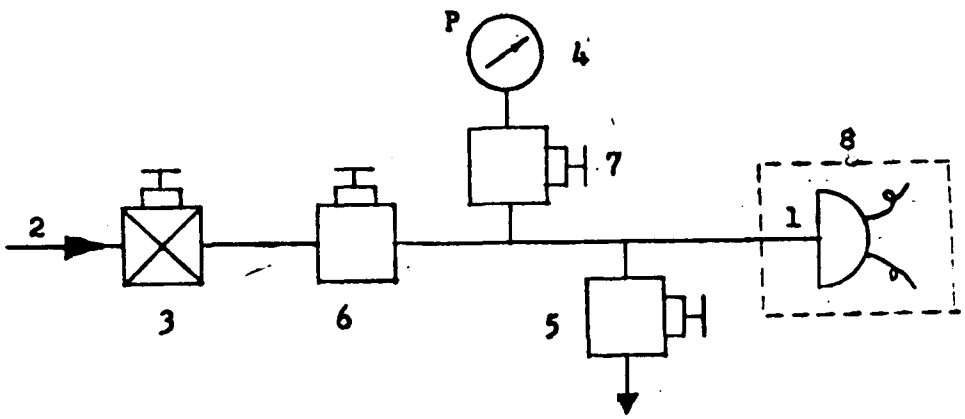
3.2.5 The specimens were removed from the test setup and inspected for damage.

3.3 TEST RESULTS

There was no leakage of the test specimens and there was no evidence of internal or external damage.

3.4 TEST DATA

The test data presented in table 3-2 were recorded during the test.



Note: Refer to table 3-1 for item identification.
All line sizes 1/4-inch.

Figure 3-1. Proof Pressure Test Schematic

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 Actuation of test specimens 1 and 2 (4231-1) shall occur on increasing pressure at 100 (±15) psig. The differential pressure ("dead-band") shall not exceed 30 psi.

4.1.2 Actuation of test specimen 3 (4231-2) shall occur on increasing pressure at 625 (±15) psig. The differential pressure shall not exceed 55 psi.

4.1.3 Each test specimen shall be operated 10 times during the functional test.

4.1.4 Voltage drop across the normally open and the normally closed contacts shall not exceed 300 millivolts when a 3-ampere, 28-vdc resistive load is applied to the contacts (contacts in closed position).

4.1.5 The insulation resistance, when measured between all non-connected pins and between each pin and case, shall not be less than 20 megohms at 500 vdc.

4.1.6 The dielectric strength when measured between all non-connected pins and between each pin and case, shall be such that the leakage current shall not exceed 2 milliamperes when 1000 vac (rms) 60 cps is applied. (Use 1000 vac only during initial functional test, 500 vac during all other functional tests.)

4.2 TEST PROCEDURE

4.2.1 The test setup was assembled as shown in figures 4-1 and 4-2, using all the equipment listed in table 4-1 except items 9 through 13.

4.2.2 Hand valve 3 and relief valve 5 were opened and the system was purged of air using a low flow from the regulated source.

4.2.3 Relief valve 5 was closed and the regulated source pressure was slowly increased until the specimen actuated. The actuation pressure was recorded.

4.2.4 The regulated source pressure was slowly decreased until the specimen deactuated. The deactuation pressure was recorded and the pressure was reduced to zero.

4.2.5 Steps 4.2.3 and 4.2.4 were repeated until each test specimen was actuated and deactuated 10 times.

4.2.6 Lamps 7 and 8 were removed from the test setup and replaced with load banks 12 which were adjusted to 3-ampere loads at 28 vdc.

4.2.7 The differential voltmeter 9 was connected across pins C and B of J1, and the contact voltage drop across the normally closed contacts was measured and recorded.

4.2.8 The differential voltmeter was disconnected and the regulated source pressure was increased slowly until the specimen actuated.

4.2.9 Differential voltmeter 9 was connected across pins B and A of J1 and the contact voltage drop across the normally open contacts was measured and recorded.

4.2.10 The electrical portions of the test setup were removed by disconnecting P1 (figure 4-2) and the regulated source pressure was reduced to zero.

4.2.11 Megohmmeter 11 was connected to pins B and A of J1, and with 500 vdc applied to the pins, the insulation resistance was measured and recorded.

4.2.12 Megohmmeter 11 was connected to pins C and B of J1 and the test specimen was actuated. The 500 vdc test voltage was applied and the insulation resistance was measured and recorded.

4.2.13 The insulation resistance between each pin of J1 and the test specimen case was measured and recorded by applying 500 vdc between the pins and case.

4.2.14 The megohmmeter was removed and the insulation tester 10 was connected between pins C and B of J1 with the test specimen in the actuated position.

4.2.15 The test voltage was gradually increased from zero to 1000 vac (rms) and was maintained for 60 seconds. The highest leakage current was recorded.

4.2.16 The regulated source pressure was reduced to zero and the insulation tester was connected between pins A and C of J1. Step 4.2.15 was repeated.

4.2.17 The leakage current between each pin of J1 and the test specimen case was measured and recorded by applying 1000 vac between the pins and case.

4.3 TEST RESULTS

4.3.1 Specimens 1 and 2 actuated and deactuated within the specified limits. The differential pressure of specimen 3 exceeded the maximum allowable "dead-band."

4.3.2 The contact voltage drop was less than 300 millivolts for all measurements.

4.3.3 The insulation resistance was greater than 20 megohms for all measurements.

4.3.4 The dielectric strength (leakage current) was less than 2 milliamperes for all measurements.

4.4 TEST DATA

Data recorded during the initial functional test are presented in table 4-2.

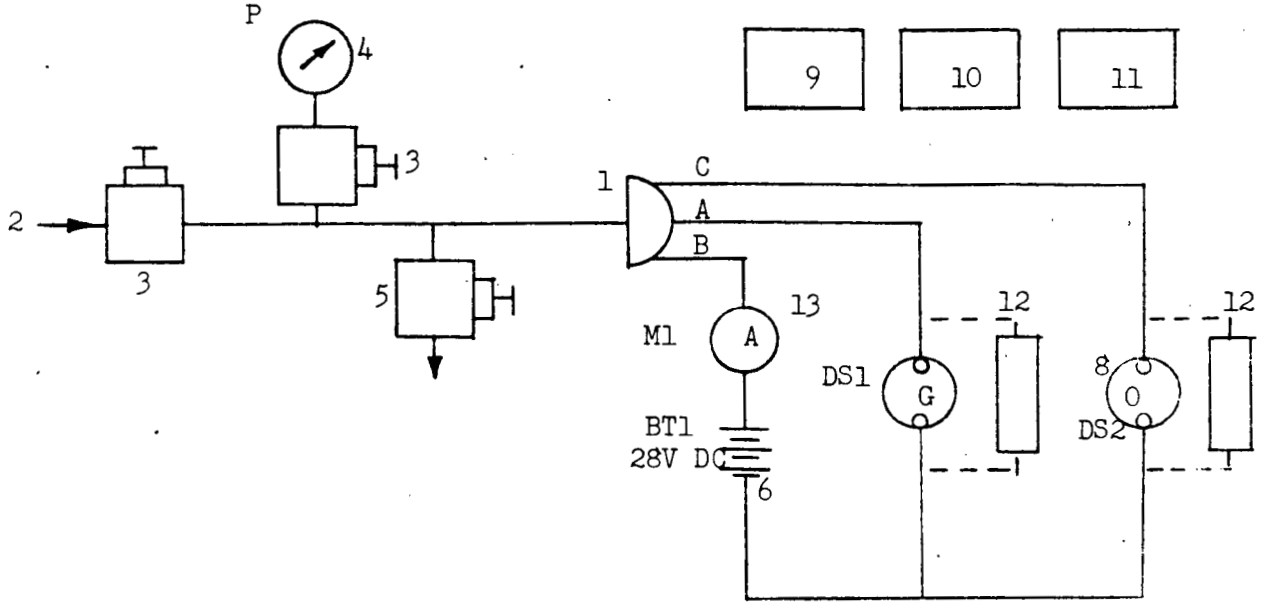
Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Helicoid Gage	4231-1 4231-2	NA	Pressure Switch
2	Regulated GN_2 Source	NA	NA	NA	650 psi
3	Hand Valve	Robbins	ANA 250-4T	NA	1/4-inch
4	Pressure Gage	Heise	H41249	1003-B	0 to 150 psig ±0.1% FS Cal date 3-7-67
4	Pressure Gage	Heise	H35957	01533	0 to 1500 psig ±0.1% FS Cal date 5-29-67
5	Relief Valve	Robbins	ANA 250-4T	NA	1/4-inch
6	Power Source	Lambda	LA5003BM	010270	28-vdc
7	Lamp (DS1)	General Electric	327	NA	Green
8	Lamp (DS2)	General Electric	327	NA	Orange
9	Differential Voltmeter	John Fluke	821A	156	±0.1% accuracy
10	Insulation Tester	Wiley	5	015241	
11	Megohmmeter	General Radio	1862-B	01845	
12	Load Bank	CCSD	NA	NA	5-ampere, 28-vdc
13	Ammeter	Simpson	NA	NA	0-to 10-ampere (built into load bank)

Table 4-2. Initial Functional Test Operating Pressures

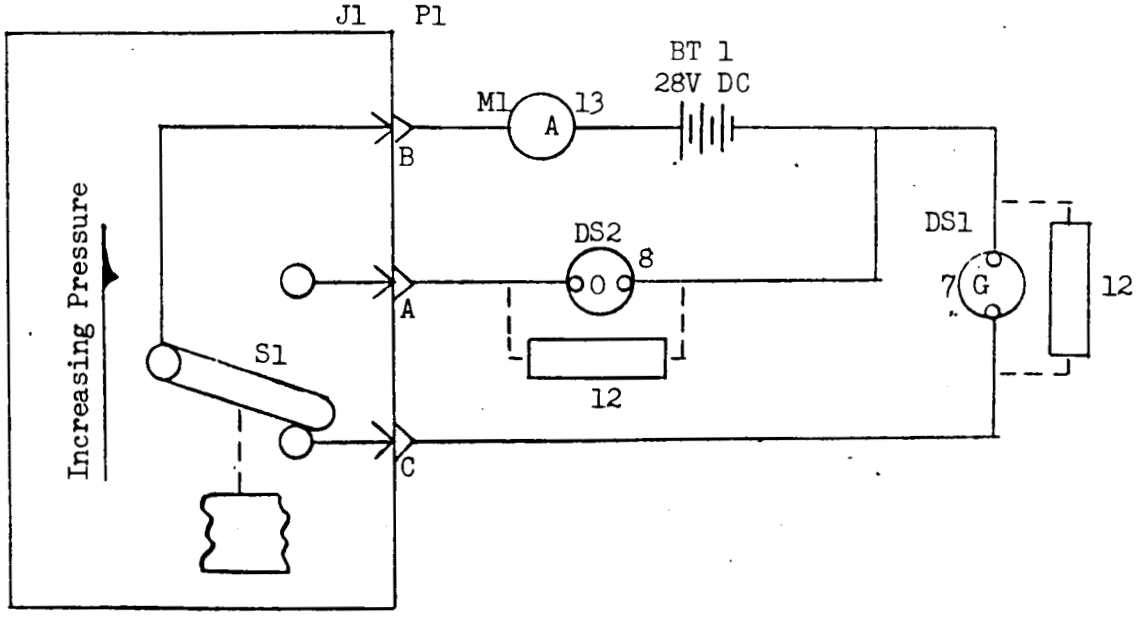
Specimen Number	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Differential Pressure (psi)	Specified Differential Pressure (psi max)
1	100	100 (±15)	7	30
2	100	100 (±15)	8	30
3	625	625 (±15)	* 57	55

* Out of tolerance (not readjusted after test)



Note: Refer to table 4-1 for item identification.
All lines $\frac{1}{4}$-inch.

Figure 4-1. Functional Test Schematic



Note: Refer to table 4-1 for item identification.
All lines $\frac{1}{4}$-inch.

Figure 4-2. Functional Test Wiring Schematic

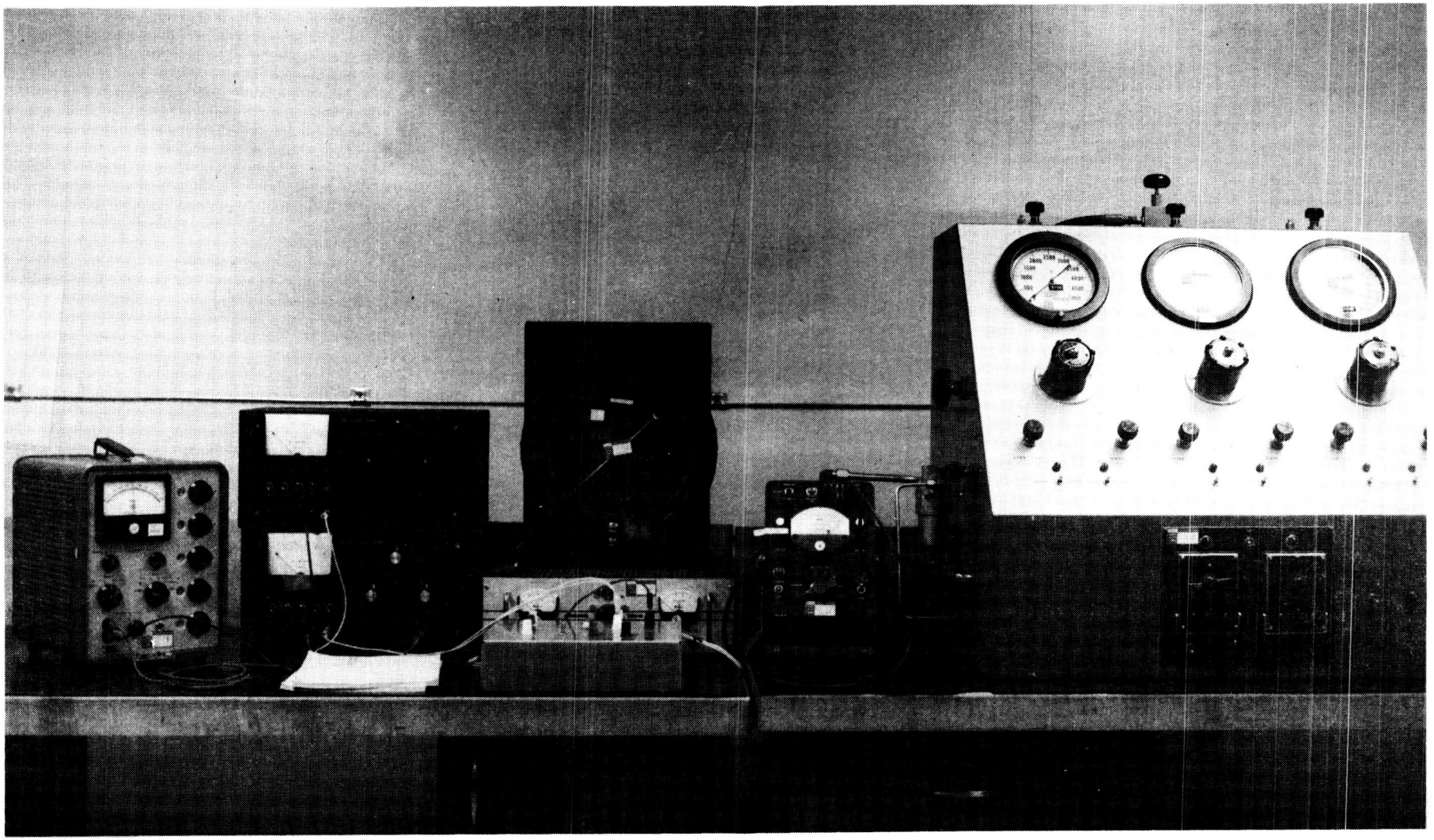


Figure 4-3. Functional Test Setup

SECTION V

LOW TEMPERATURE TEST

5.1 TEST REQUIREMENTS

5.1.1 Test specimens 1 and 3 shall be subjected to a low temperature test of 5 (-4,+0)°F to determine whether the environment causes degradation or deterioration of the specimens.

5.1.2 A functional test as prescribed in section IV shall be performed before the test (if more than 72 hours has elapsed since the last functional test), during the test, and within one hour after stabilization at ambient temperature after the test.

5.2 TEST PROCEDURE

5.2.1 The test specimens were placed in the low temperature chamber and all necessary electrical and pneumatic systems were connected.

5.2.2 A functional test was performed according to section IV.

5.2.3 The chamber temperature was decreased at the rate of one degree per minute and stabilized at 5 (-4, +0)°F.

5.2.4 A functional test (refer to 5.1.2) was performed when temperature stabilization was attained.

5.2.5 The chamber temperature was returned to ambient upon completion of the functional test.

5.2.6 The test specimens were visually inspected and functionally tested within one hour following the return to ambient conditions.

5.3 TEST RESULTS

5.3.1 Specimen 1 was stuck in the deactuated position prior to the low temperature test. After turning the pressure adjustment screw, the unit began to operate properly. The actuation pressure was reset at 100 psig and testing was continued. During the adjustment procedure the set pressure dial pointer fell off.

5.3.2 The specimens actuated and deactuated within the specified limits during the low temperature functional tests.

5.3.3 The contact voltage drop, insulation resistance, and dielectric strength measurements were all within the specified limits.

5.4 TEST DATA

Data recorded during the low temperature functional tests are presented in table 5-1.

Table 5-1. Low Temperature Functional Test Operating Pressures

Temperature Test	Specimen 1		Specimen 3	
	Average Actuation Pressure (psig)	Average Differential Pressure (psi)	Average Actuation Pressure (psig)	Average Differential Pressure (psi)
Before	100	7	623	55
During	100	7	625	53
After	100	8	623	* 56

* Out of tolerance (not readjusted after test)

Specification Levels

	Actuation Pressure (psig)	Differential Pressure (psi max)
Specimen 1	100 (±30)	30
Specimen 3	625 (±50)	55

SECTION VI

HIGH TEMPERATURE TEST

6.1 TEST REQUIREMENTS

6.1.1 Test specimens 1 and 3 shall be subjected to a high temperature test of 160 (-0, +4)°F to determine whether the environment causes degradation or deterioration of the specimens.

6.1.2 A functional test as prescribed in section IV shall be performed before the test (if more than 72 hours have elapsed since the last functional test), during the test, and within one hour after stabilization at ambient temperature after the test.

6.2 TEST PROCEDURE

6.2.1 The test specimens were placed in the high temperature chamber and all necessary electrical and pneumatic systems were connected.

6.2.2 The chamber temperature was increased at the rate of one degree per minute and stabilized at 160 (-0, +4)°F.

6.2.3 A functional test (refer to 6.1.2) was performed when temperature stabilization was attained.

6.2.4 The chamber temperature was returned to ambient upon completion of the functional test.

6.2.5 The test specimens were visually inspected and functionally tested within one hour following the return to ambient.

6.3 TEST RESULTS

6.3.1 The test specimens actuated and deactuated within the specified limits during the functional tests and there was no apparent deterioration or degradation of the specimens.

6.3.2 The contact voltage drop, insulation resistance, and dielectric strength measurements were all within the specified limits.

6.4 TEST DATA

Data recorded during the high temperature functional tests are presented in table 6-1.

Table 6-1. High Temperature Functional Test Operating Pressures

Temperature Test	Specimen 1		Specimen 3	
	Average Actuation Pressure (psig)	Average Differential Pressure (psi)	Average Actuation Pressure (psig)	Average Differential Pressure (psi)
Before	100	8	623	*56
During	99	7	620	55
After	99	7	624	52

* Out of tolerance (not readjusted after test)

	Specification Levels	
	Actuation Pressure (psig)	Differential Pressure (psi max)
Specimen 1	100 (±30)	30
Specimen 3	625 (±50)	55

SECTION VII

VIBRATION TESTS

7.1 TEST REQUIREMENTS

7.1.1 Test specimens 1, 2, and 3 shall be subjected to sinusoidal and random excitation to determine the capability of the specimens to operate satisfactorily during and after vibration testing.

7.1.2 The tests shall be performed in the horizontal and vertical axes (see figure 7-1).

7.1.3 The tests shall be conducted in accordance with section 9, procedure Ia of KSC-STD-164(D).

7.1.4 Acceleration shall be measured by accelerometers mounted on the test specimens.

7.1.5 The specimens shall be monitored for contact chatter during each vibration test.

7.1.6 A functional test shall be performed prior to the vibration tests and immediately following the sinusoidal sweep and random excitation test in each axis.

7.2 TEST PROCEDURE

7.2.1 The test specimens were installed on a vibration fixture and the fixture was mounted on the vibrator. All necessary electrical and pneumatic systems were connected.

7.2.2 A functional test was performed according to section IV.

7.2.3 The resonant frequency search was performed while vibrating the test specimens at the input levels specified in table 7-1.

7.2.4 The specimen contacts were monitored for chatter with the test specimen deactuated from 5 to 3000 cps and actuated from 3000 to 5 cps.

7.2.5 The sinusoidal search was performed while vibrating the test specimens at the 1/3-octave center frequencies given in table 7-2. The input level was increased until functional degradation occurred or until the maximum level was attained.

7.2.6 The specimen contacts were monitored for chatter with the test specimen actuated.

7.2.7 The sinusoidal sweep test was conducted at the levels specified in table 7-1.

7.2.8 The specimen contacts were monitored for chatter with the test specimens deactuated from 10 to 2000 cps and actuated from 2000 to 10 cps.

7.2.9 A functional test was performed after the sinusoidal sweep test.

7.2.10 The random excitation test was conducted by vibrating the specimens at the levels specified in table 7-1. The specimen contacts were monitored for chatter with the test specimen alternately pressurized for 1 minute and depressurized for 1 minute until 5 minutes had elapsed.

7.2.11 A functional test was performed after the random excitation test.

7.3 TEST RESULTS

7.3.1 The set pressure dial pointer and blowout disc of specimen 1 came loose during the Y-axis sinusoidal search at the 25 cps center frequency with the maximum input level applied (8.2g peak). "Bottoming" of the specimen occurred and the shock mount screws hit the vibration fixture (figure 7-1). The flexible pressure hose was removed to lessen the weight on the shock mounts and the test was continued. "Bottoming" occurred at 40 cps, 21g peak input, causing the plexiglas lens to rotate, the nameplate to loosen, and the Micro Switch contact arm to bend downward making the specimen inoperative (figures 7-3 and 7-4). Vibration testing of specimen 1 was discontinued.

7.3.2 Contact chatter was observed at 30 and 50 cps during the sinusoidal downsweep (2000 to 10 cps) of specimen 2 in the X-axis configuration (pressurized condition). The input levels were lowered from 21g peak and 0.25 inch DA to 20g peak and 0.20 inch DA, respectively. No further chatter was observed.

7.3.3 Specimen 2 was inadvertently subjected to 20 grms during the X-axis random excitation test. No contact chatter was observed during the test.

7.3.4 A crack in the capillary tubing of specimen 2 near the bleeder port was detected during the functional test performed after random vibration in the X-axis. The operating pressures were within the specified limits so testing was continued.

7.3.5 Deactuation of specimen 2 occurred at 30 cps during the sinusoidal downsweep (2000 to 10 cps) in the Y-axis due to an increase in the leakage rate of the capillary tube (figure 7-5). The specimen was no longer operational so testing was discontinued.

7.3.6 The shock mounts on the specimens were damaged during the vibration tests. Some had cuts in the flexible portion of the mount and all were gouged around the support posts. The mounts effectively isolate the specimens above 125 cps. Between 25 and 40 cps, at the maximum input levels, the specimens are subject to "bottoming" due to the weight of the specimens on the shock mounts.

7.3.7 The damaged specimens were returned to the vendor for evaluation and repairs. A new Micro Switch was installed in specimen 1 and the capillary tubing of specimen 2 was shortened after which the units were reassembled and reset.

7.4 TEST DATA

7.4.1 Data recorded during the vibration functional tests are recorded in tables 7-3 and 7-4.

7.4.2 A sinusoidal input plot (acceleration versus frequency) is presented in figure 7-6.

7.4.3 A typical random equalization plot (specimen 2, X-axis) is presented in figure 7-7.

Table 7-1. Vibration Test Levels

Vibration Test	Time (Minutes)	Frequency (cps)	Input Level
Resonant Frequency Search	15	5 to 3000 3000 to 5	1.0g peak 1.0g peak
Sinusoidal Sweep	15	10 to 40 40 to 2000 2000 to 40 40 to 10	0.25 inch DA 21.0g peak 21.0g peak 0.25 inch DA
Random	5	10 to 2000	7.1 grms

Table 7-2. One-Third Octave Center Frequencies

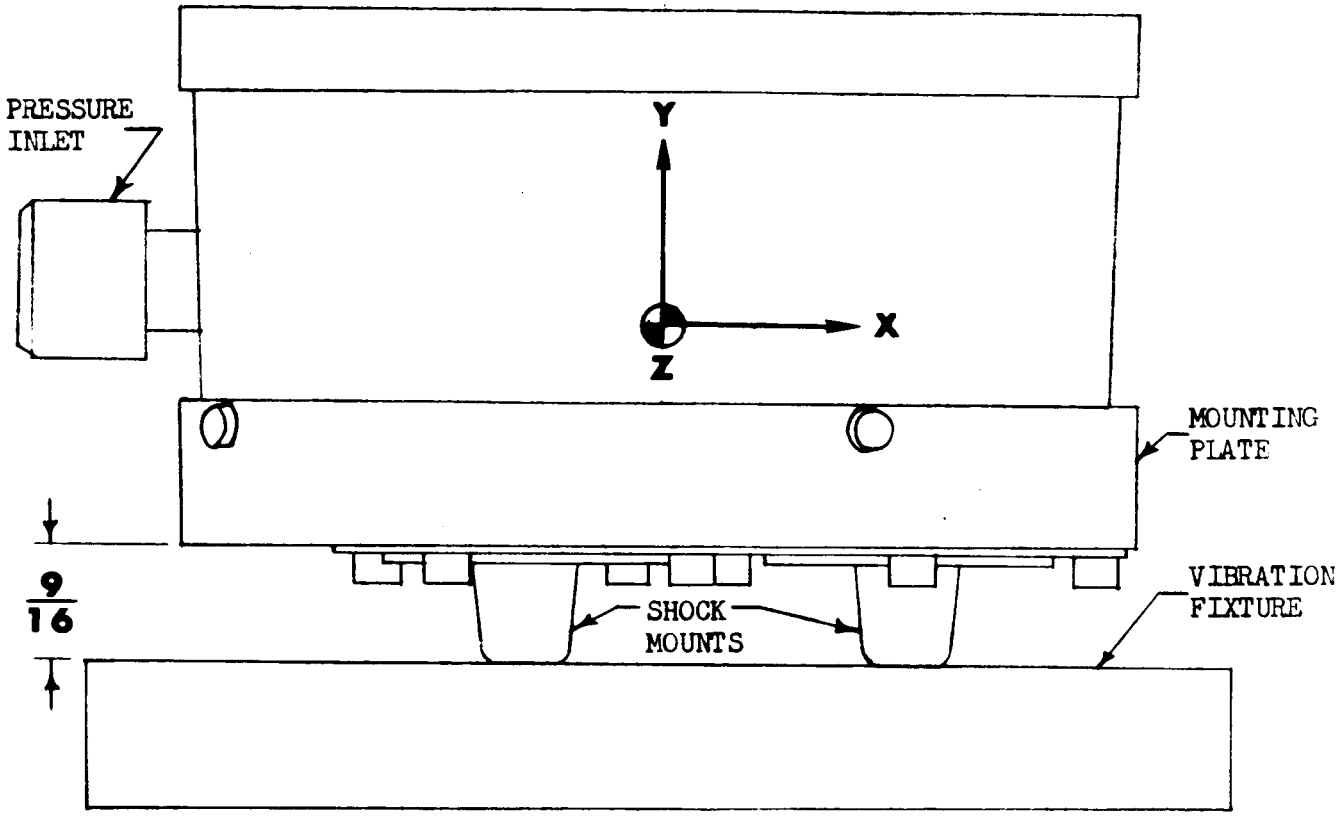
1/3-Octave Bandwidth Frequencies (cps)	Maximum Input (g level)
10	1.3
12.5	2.0
16	3.4
20	5.1
25	8.2
32	13.0
40	21.0
50	21.0
62	21.0
80	21.0
100	21.0
125	21.0
160	21.0
200	21.0
250	21.0
320	21.0
400	21.0
500	21.0
630	21.0
800	21.0
1000	21.0
1250	21.0
1600	21.0
2000	21.0

Table 7-3. Functional Test Operating Pressures Before Vibration Tests

Specimen Number	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Average Differential Pressure (psi)	Specified Differential Pressure (psi max)
1	100	100 ($\pm$15)	7	30
2	100	100 ($\pm$15)	8	30

Table 7-4. Vibration Functional Test Operating Pressures for Specimen 2

Test Axis	Test	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Average Differential Pressure (psi)	Specified Differential Pressure (psi max)
Y	Sine	102	100 (±15)	8	30
	Random	102	100 (±15)	8	30
X	Sine	102	100 (±15)	8	30
	Random	106	100 (±15)	8	30



Axes of Vibration

(For reference only)

Figure 7-1. Axes of Vibration

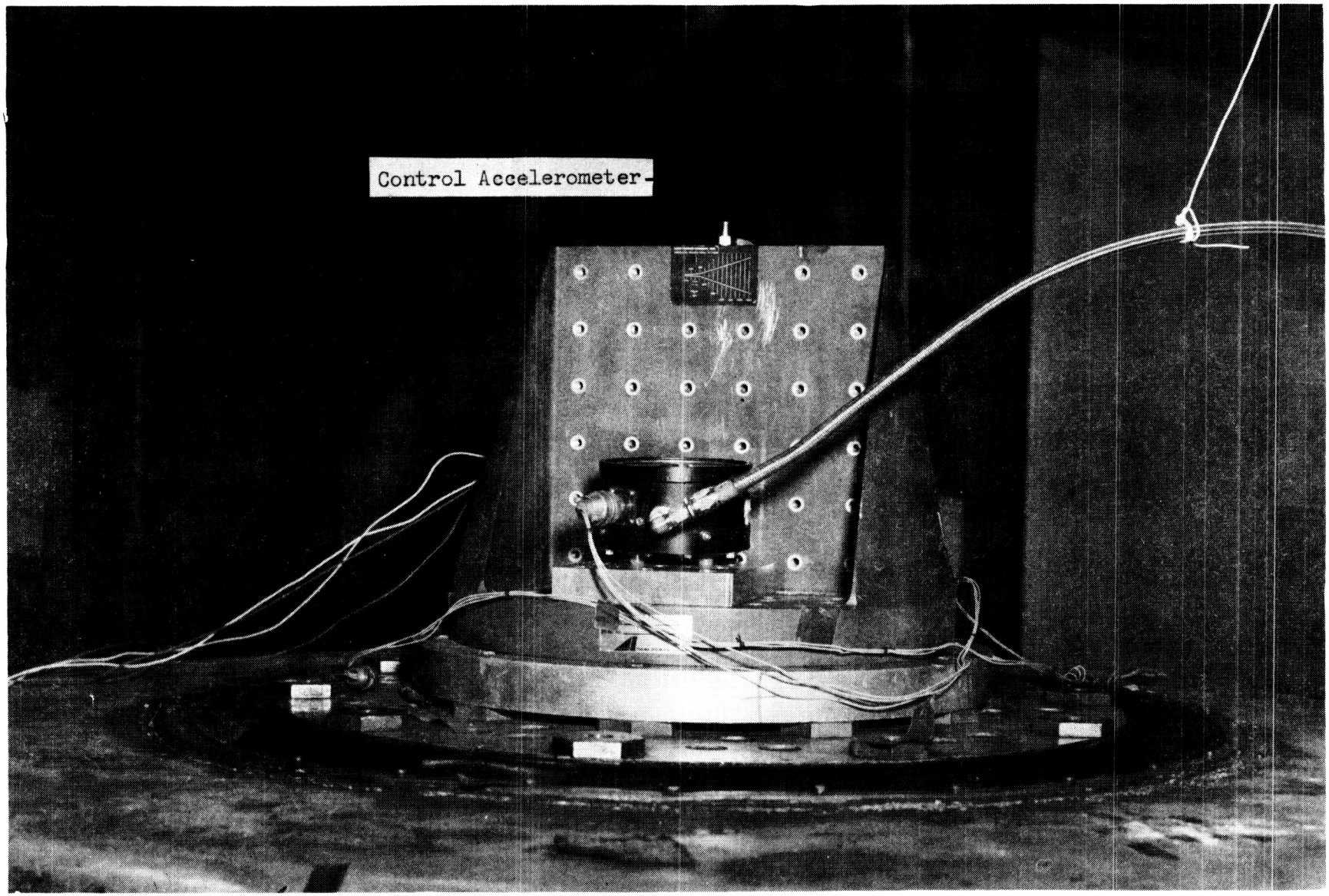


Figure 7-2. Vibration Test Setup (Y-Axis)

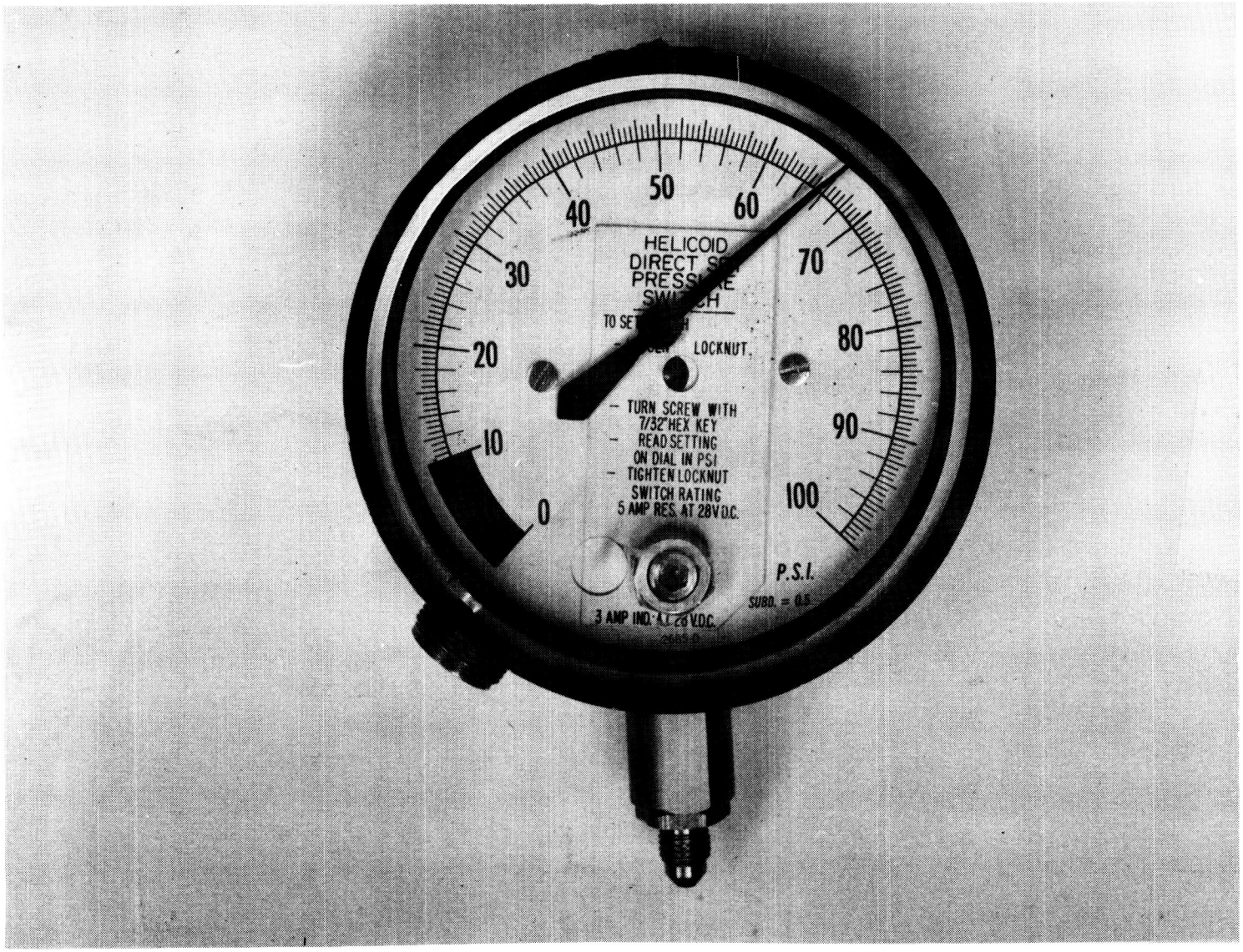


Figure 7-3. Specimen 1 After Vibration Test (Y-Axis)

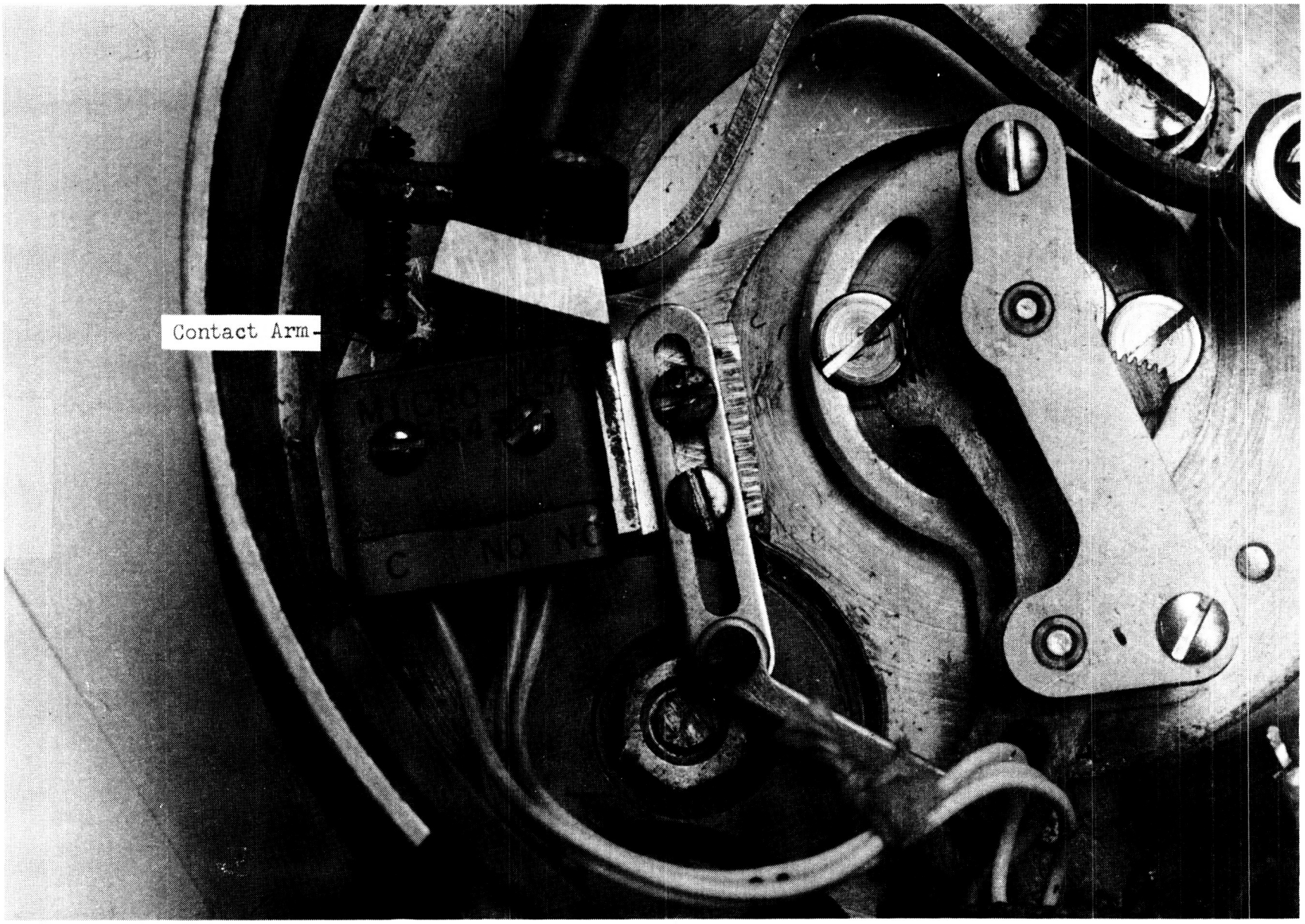


Figure 7-4. Micro Switch in Specimen 1 After Vibration Test (Y-Axis)

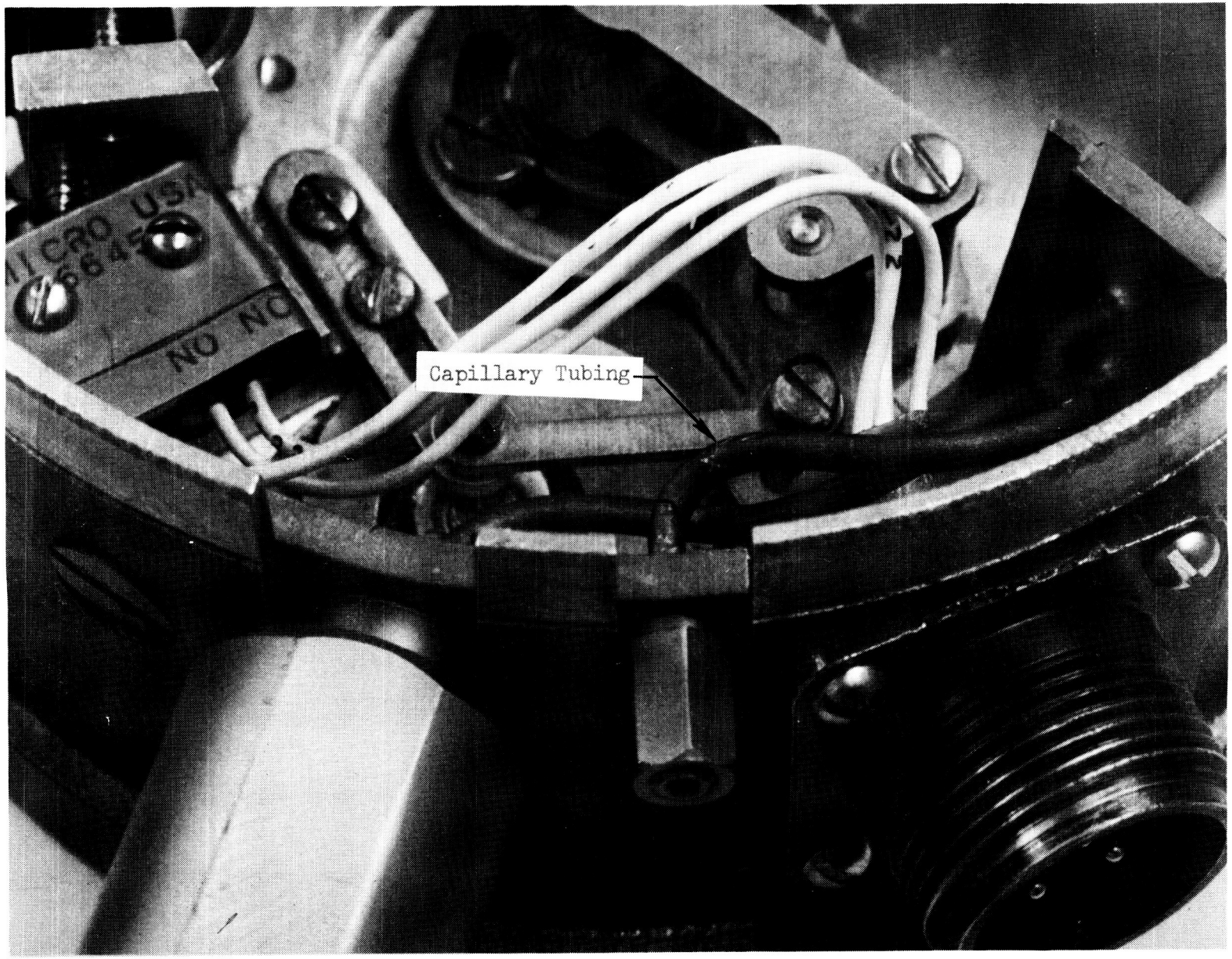


Figure 7-5. Break in Specimen 2 Capillary Tubing

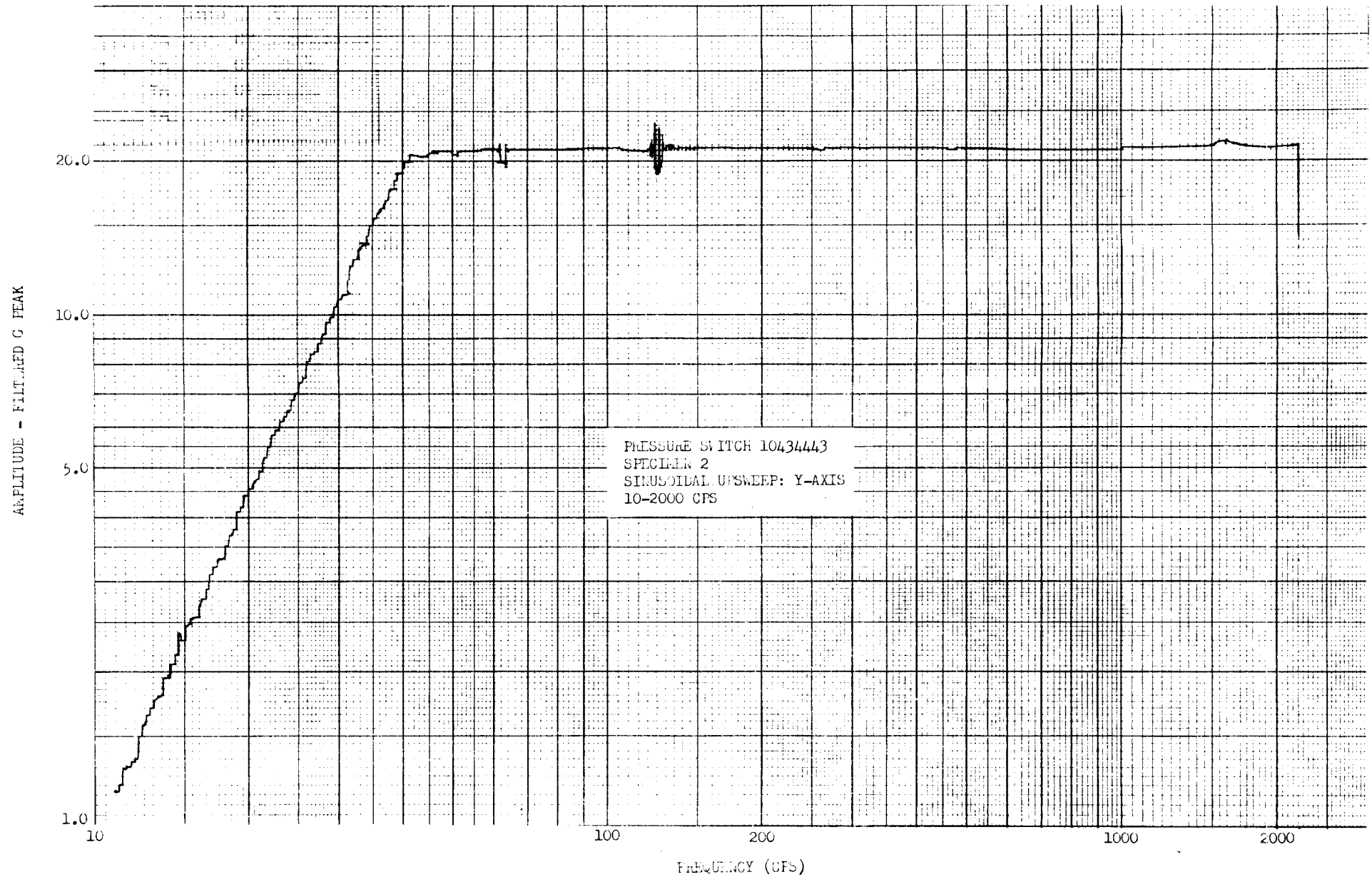


Figure 7-6. Vibration Input Plot (Control Accelerometer)

Figure 7-7. Typical Random Equalization Plot

SECTION VIII

HUMIDITY TEST

8.1 TEST REQUIREMENTS

8.1.1 A humidity test shall be performed on test specimens 2 and 3 to determine whether the environment causes degradation or deterioration of the specimens.

8.1.2 The specimens shall be exposed to the humidity environment for a period of 240 hours.

8.1.3 A functional test as prescribed in section IV shall be performed before the test (if more than 72 hours has elapsed since the last functional test) and within one hour after completion of the humidity test.

8.1.4 The humidity test shall be conducted in accordance with section 12 of KSC-STD-164(D).

8.2 TEST PROCEDURE

8.2.1 A functional test was performed on the test specimens prior to placing the specimens in the humidity chamber.

8.2.2 The test specimens were placed in the humidity chamber with the initial temperature between 68 and 100°F, uncontrolled humidity.

8.2.3 During the first 2 hour period the chamber temperature was increased to 160°F and the relative humidity was increased to 95 (-0, +5) percent. The temperature and humidity were maintained for a 6 hour period.

8.2.4 During the next 16 hours the temperature was reduced at a linear rate to ambient while maintaining the 95 percent relative humidity.

8.2.5 The steps taken in 8.2.3 and 8.2.4 were repeated 9 times for a total exposure of 240 hours.

8.2.6 At the conclusion of the test the specimens were removed from the chamber and a functional test was performed.

8.3 TEST RESULTS

8.3.1 The test specimens actuated and deactuated within the specified limits during the functional tests and there was no apparent deterioration or degradation of the specimens.

8.3.2 The insulation resistance and dielectric strength measurements were all within the specified limits.

8.3.3 The contact voltage drop across pins B and C of specimen 2 was 0.82-volt after the humidity test. The specification limit is 0.30-volt maximum. The contact voltage drop measurement was repeated after 24 hours and it was unchanged.

8.4 TEST DATA

Data recorded before and after the humidity test are presented in table 8-1.

Table 8-1. Humidity Functional Test Operating Pressures

Humidity Test	Specimen 2		Specimen 3	
	Average Actuation Pressure (psig)	Average Differential Pressure (psi)	Average Actuation Pressure (psig)	Average Differential Pressure (psi)
Before	97	7	630	50
After	97	6	625	55

Specification Levels

	Actuation Pressure (psig)	Differential Pressure (psi max)
Specimen 2	100 (±15)	30
Specimen 3	625 (±15)	55

SECTION IX

SALT FOG TEST

9.1 TEST REQUIREMENTS

9.1.1 Test specimens 1, 2, and 3 shall be subjected to a salt fog test to determine the extent of the degradation or deterioration resulting from the environmental exposure.

9.1.2 The salt solution shall be a 5 percent by weight mixture and shall have a pH factor of 6.5 to 7.2. Test temperature shall be 95 (+2, -4)°F.

9.1.3 A functional test as prescribed in section IV shall be performed prior to exposure (if more than 72 hours has elapsed since the last functional test) and within one hour after removal from the salt fog environment.

9.2 TEST PROCEDURE

9.2.1 The test specimens were inspected for corrosion, dirt, and oily films prior to the salt fog test and were cleaned before being installed in the salt fog chamber.

9.2.2 The test specimens were placed in the chamber in a manner which would permit the fog to reach all sides of the specimens without condensate dripping on them.

9.2.3 The specimens were exposed to the salt fog atmosphere for 240 hours.

9.2.4 A functional test was performed according to section IV after removal from the chamber.

9.2.5 The test specimens were inspected for corrosion caused by exposure to the salt fog atmosphere.

9.3 TEST RESULTS

9.3.1 The specimen housings were corroded internally and externally and salt spray was present on the internal parts of each specimen.

9.3.2 The differential pressure of specimen 3 after the salt fog test was 60 psi. Specification limit is 55 psi, maximum.

9.3.3 The insulation resistance of specimen 1 (pin B and case and pin C and case) and specimen 2 (all measurements) was below the specified 20 megohm minimum. The insulation resistance measurements were repeated after 72 hours and all were greater than 20 megohms.

9.3.4 The contact voltage drop between pins B and C of specimen 2 was 0.80 volts. Specified maximum voltage drop is 0.30 volts. The measurement was repeated after 72 hours and was unchanged.

9.4 TEST DATA

Data recorded before and after the salt fog test are presented in table 9-1.

Table 9-1. Salt Fog Functional Test Operating Pressures

Specimen Number	Average Actuation Pressure (psig)		Average Differential Pressure (psi)	
	Before	After	Before	After
1	98	97	6	5
2	96	97	6	7
3	625	620	55	* 60

* Out of tolerance **(not readjusted after test)**

Specification Levels

	Actuation Pressure (psig)	Differential Pressure (psi max)
Specimen 1	100 (±15)	30
Specimen 2	100 (±15)	30
Specimen 3	625 (±15)	55

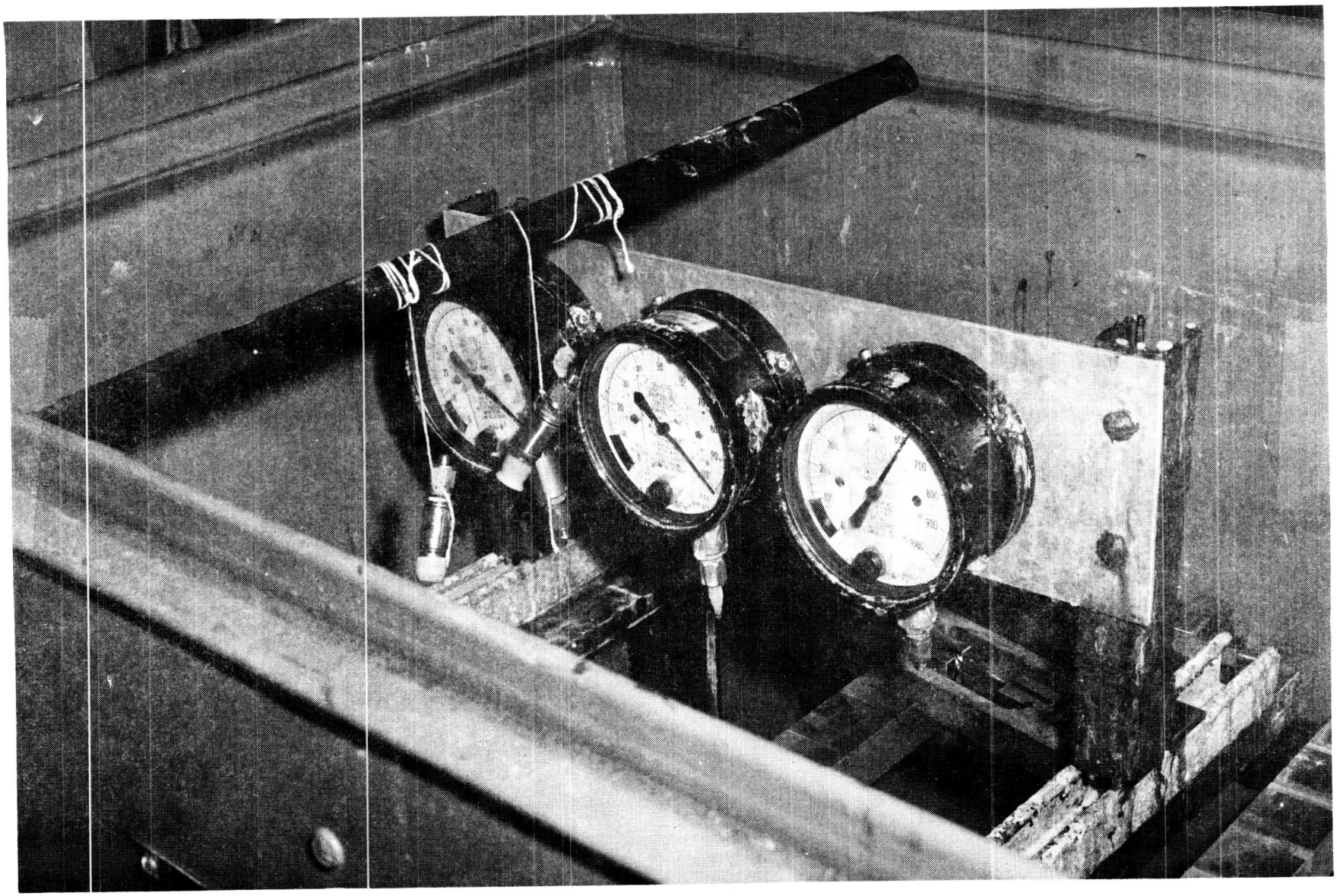


Figure 9-1. Salt Fog Test Setup

SECTION X

EXPLOSION TEST

10.1 TEST REQUIREMENTS

10.1.1 Test specimens 1 and 3 shall be subjected to an explosion test (ignition proof test) to determine the explosion-producing characteristics of the specimens when operated in an explosive atmosphere.

10.1.2 The explosive mixture shall be composed of 32 (±5) percent by volume of hydrogen-in-air and the test chamber pressure shall be 13.1 psig at a temperature of 160 (+2, -4)°F.

10.1.3 The specimens shall be operated while in the explosive atmosphere.

10.1.4 A functional test shall be performed prior to and at the completion of the test.

10.2 TEST PROCEDURE

10.2.1 The specimens were placed in the test chamber and all necessary electrical and pneumatic systems were connected as shown in figure 4-1.

10.2.2 The temperature within the test chamber was stabilized at 160°F and the pressure was decreased to 13.1 psia.

10.2.3 The explosive atmosphere was injected into the chamber and the internal pressure was adjusted to 13.1 psia.

10.2.4 The specimens were actuated and deactuated 10 times while in the explosive atmosphere.

10.2.5 The explosive atmosphere was verified and the chamber pressure was adjusted to 14.7 psia. Paragraph 10.2.4 was repeated.

10.2.6 The explosive atmosphere was verified and the chamber was purged with gaseous nitrogen.

10.3 TEST RESULTS

10.3.1 The specimens operated successfully in the specified explosive atmosphere and during the functional test performed after the explosion test. There was no apparent deterioration or degradation of the specimens.

10.4 TEST DATA

Data recorded before and after the explosion test are presented in table 10-1.

Table 10-1. Functional Test Data Obtained Before and After Explosion Test

Specimen Number	Average Actuation Pressure (psig)		Average Differential Pressure (psi)	
	Before	After	Before	After
1	97	100	5	7
3	620	623	* 60	* 60

* Out of tolerance (not readjusted after test)

Specification Levels

	Actuation Pressure (psig)	Differential Pressure (psi max)
Specimen 1	100 (±15)	30
Specimen 3	625 (±15)	55

SECTION XI

VIBRATION TESTS (RETEST)

11.1 TEST REQUIREMENTS

11.1.1 Test specimens 1, 2, and 3 shall be subjected to sinusoidal and random excitation to determine the capability of the specimens to operate satisfactorily during and after vibration testing.

11.1.2 The tests shall be performed in the horizontal and vertical axes (figure 7-1).

11.1.3 The tests shall be conducted in accordance with section 9, procedure Ia of KSC-STD-164(D).

11.1.4 Acceleration shall be measured by accelerometers mounted on the test specimens.

11.1.5 The specimens shall be monitored for contact chatter during each vibration test.

11.1.6 A functional test shall be performed prior to the vibration tests and immediately following the sinusoidal sweep and random excitation test in each axis.

11.2 TEST PROCEDURE

11.2.1 The test specimen was installed on a vibration fixture and the fixture was mounted on the vibrator. All necessary electrical and pneumatic systems were connected.

11.2.2 A functional test was performed according to section IV.

11.2.3 The resonant frequency search was performed while vibrating the specimen at the input level specified in table 11-1.

11.2.4 The specimen contacts were monitored for chatter with the test specimen actuated from 5 to 3000 cps and deactuated from 3000 to 5 cps.

11.2.5 The sinusoidal search was performed while vibrating the specimen at the 1/3-octave center frequencies (table 7-2). The input level was increased until functional degradation occurred or until the maximum level was attained.

11.2.6 The specimen contacts were monitored for chatter with the test specimen actuated.

11.2.7 The sinusoidal sweep test was conducted at the levels specified in table 11-3.

11.2.8 The specimen contacts were monitored for chatter with the test specimens actuated from 10 to 2000 cps and deactuated from 2000 to 10 cps.

11.2.9 A functional test was performed after the sinusoidal sweep test.

11.2.10 The random excitation test was conducted by vibrating the specimens at the levels specified in table 11-1. The specimen contacts were monitored for chatter with the test specimen actuated (pressurized) during the first four minutes. During the final minute of vibration the specimen was actuated and deactuated as many times as was possible.

11.2.11 A functional test was performed after the random excitation test.

11.2.12 Steps 11.2.2 through 11.2.11 were performed on each specimen in the X-, Y-, and Z-axes.

11.3 TEST RESULTS

11.3.1 Contact chatter was observed during the sinusoidal search of specimen 1 in the X- and Z-axes. "Bottoming" of specimen 1 occurred at approximately 25 cps during the Y-axis sinusoidal downsweep. No contact chatter was observed. The operating pressures during the functional tests were all within the specified limits.

11.3.2 Contact chatter was observed during the sinusoidal sweep test of specimen 2 in the X-and Z-axes. The input levels were reduced until no degradation occurred. The actuation pressure was outside the specified limits after the Z-axis sinusoidal sweep and also after the Z-axis random vibration test.

11.3.3 Contact chatter was observed during the sinusoidal search of specimen 3 in the X-axis and during the sinusoidal sweep in the Z-axis. During the sinusoidal sweep in the Z-axis, the set pressure dial pointer fell off at approximately 40 cps (figure 11-1). The operating pressures were all within the specified limits during the functional tests.

11.3.4 The shock mounts on the specimens were damaged during the vibration tests. Some had cuts in the flexible portion of the mount and all were slightly gouged around the support posts. The mounts effectively isolated the specimens above 125 cps. It was concluded that the major resonance of the specimens occurs between 25 and 40 cps and the specimens are subject to "bottoming" due to excessive weight on the shock mounts.

11.4 TEST DATA

11.4.1 Data recorded during the vibration functional tests are recorded on tables 11-4 and 11-5.

11.4.2 A sinusoidal input plot (acceleration versus frequency) is presented in figure 11-3.

11.4.3 A typical random equalization plot is presented in figure 11-4.

Table 11-1. Vibration Test Levels

Vibration Test	Time (minutes)	Frequency (cps)	Input Level
Resonant Frequency Search	15	5 to 3000 3000 to 5	1.0g peak 1.0g peak
Random	5	10 to 2000	7.1 grms

Table 11-2. Contact Chatter Observed During Sinusoidal Search

Specimen	Test Axis	Frequency (cps)	Input Level (g peak)
1	X	20	4.5
		25	7.5
		32	12.8
		62	18.0
	Z	40	19.0
3	X	32	10.5

Table 11-3. Vibration Test Sinusoidal Input Levels

Test Axis	Specimen 1		Specimen 2		Specimen 3	
	Frequency (cps)	Input Level	Frequency (cps)	Input Level	Frequency (cps)	Input Level
X	10 to 40	0.18-in. DA	10 to 40	0.20-in. DA	10 to 40	0.18-in. DA
	40 to 2000	21.0g peak	40 to 2000	21.0g peak	40 to 2000	21.0g peak
	2000 to 40	21.0g peak	2000 to 40	21.0g peak	2000 to 40	21.0g peak
	40 to 10	0.18-in. DA	40 to 10	0.20-in. DA	40 to 10	0.18-in. DA
Y	10 to 40	0.25-in. DA	10 to 40	0.25-in. DA	10 to 40	0.25-in. DA
	40 to 2000	21.0g peak	40 to 2000	21.0g peak	40 to 2000	21.0g peak
	2000 to 40	21.0g peak	2000 to 40	21.0g peak	2000 to 40	21.0g peak
	40 to 10	0.25-in. DA	40 to 10	0.25-in. DA	40 to 10	0.25-in. DA
Z	10 to 40	0.20-in. DA	10 to 40	0.20-in. DA	10 to 45	0.20-in. DA
	40 to 50	18.0g peak	40 to 2000	21.0g peak	45 to 2000	21.0g peak
	50 to 2000	21.0g peak	2000 to 40	21.0g peak	2000 to 45	21.0g peak
	2000 to 50	21.0g peak	40 to 10	0.20-in. DA	45 to 10	0.20-in. DA
	50 to 40	18.0g peak				
	40 to 10	0.20-in. DA				

Table 11-4. Functional Test Operating Pressures Before Vibration Tests

Specimen Number	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Average Differential Pressure (psi)	Specified Differential Pressure (psi max.)
1	98	100 (±15)	5	30
2	89	100 (±15)	6	30
3	621	625 (±15)	* 58	55

* Out of tolerance (not readjusted after test)

Table 11-5. Vibration Functional Test Operating Pressures

Test Axis	Test	Specimen 1		Specimen 2		Specimen 3	
		Average Actuation Pressure (psig)	Average Differential Pressure (psi)	Average Actuation Pressure (psig)	Average Differential Pressure (psi)	Average Actuation Pressure (psig)	Average Differential Pressure (psi)
X	Sine	98	5	89	5	620	52
	Random	98	5	89	5	620	51
Y	Sine	97	4	89	5	613	51
	Random	98	6	89	6	613	50
Z	Sine	98	5	* 83	5	617	54
	Random	98	5	* 83	5	617	53

* Out of tolerance (not readjusted after test)

Specification Levels

	Actuation Pressure (psig)	Differential Pressure (psi max.)
Specimens 1 and 2	100 (±15)	30
Specimen 3	625 (±15)	55

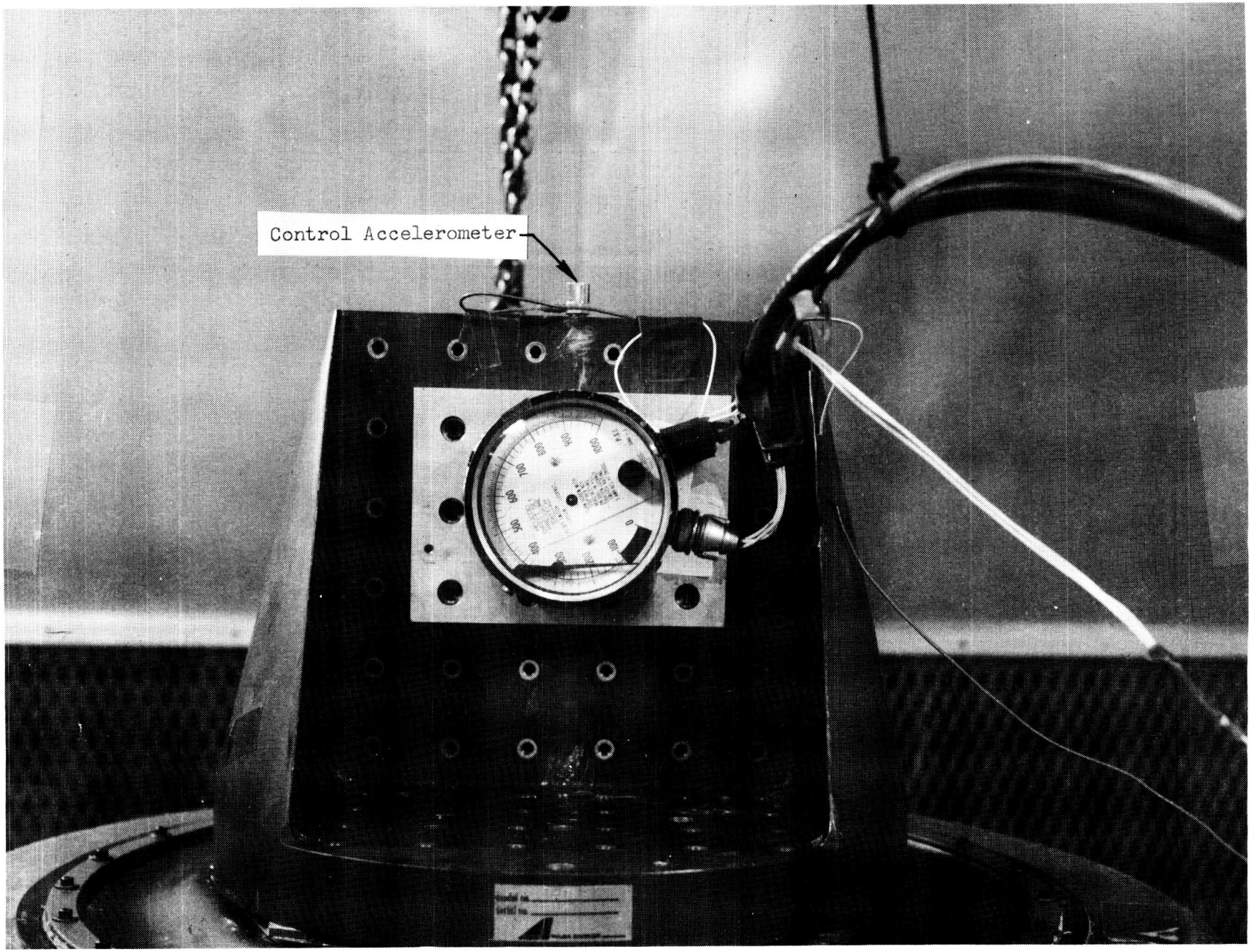


Figure 11-1. Vibration Test Setup (Specimen 3, Z-Axis)

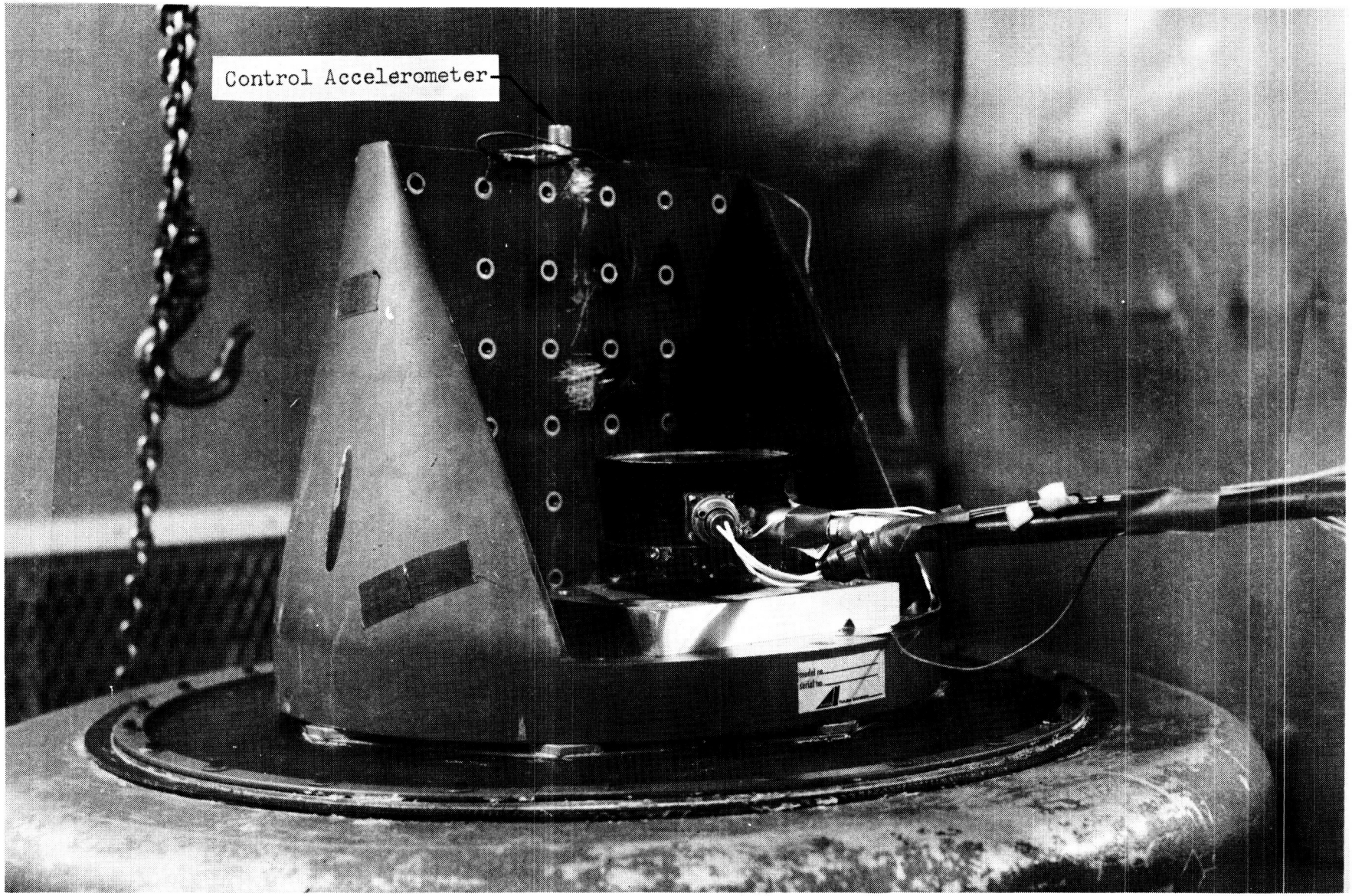


Figure 11-2. Vibration Test Setup (Specimen 1, Y-Axis)

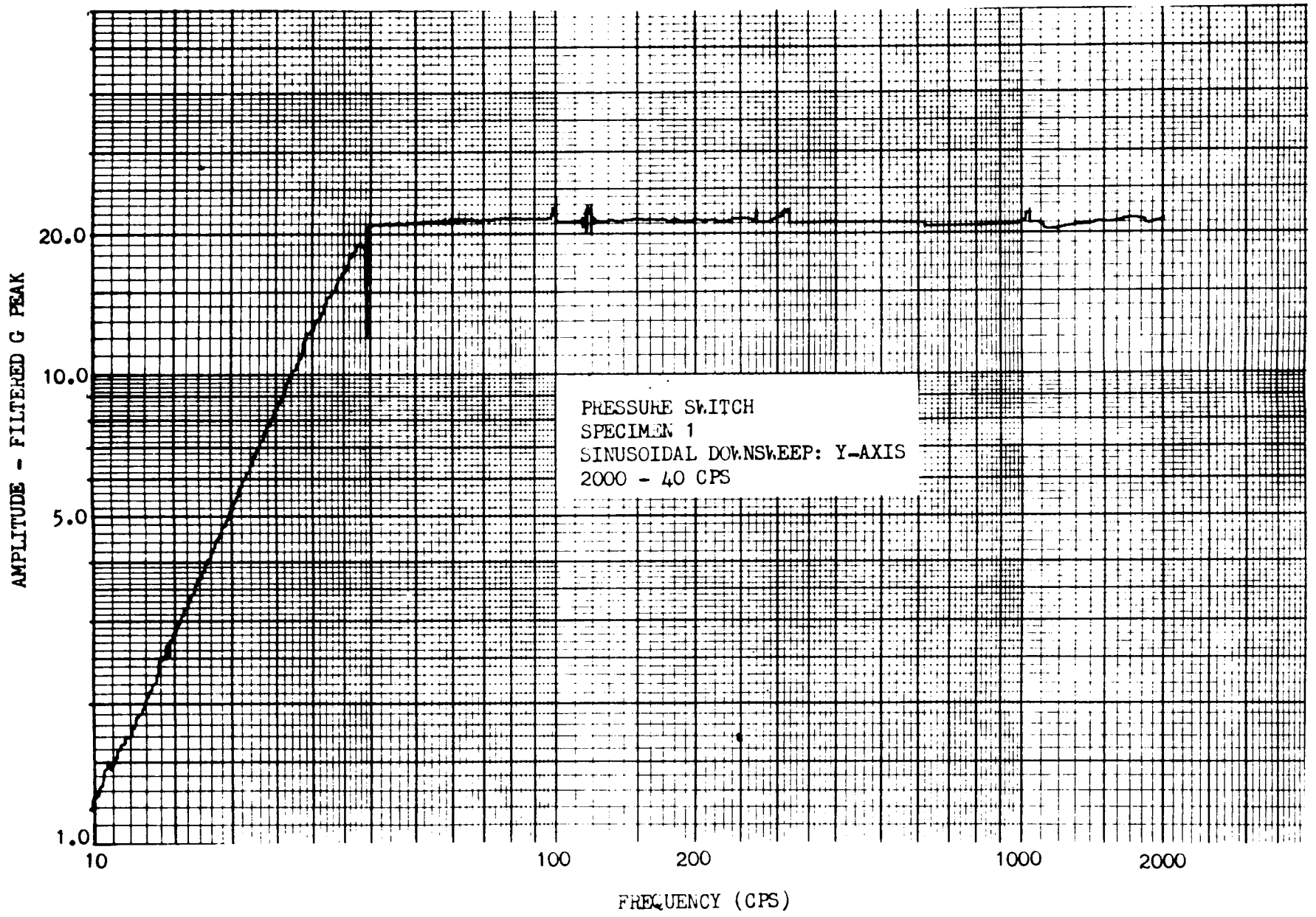


Figure 11-3. Vibration Input Plot (Control Accelerometer)

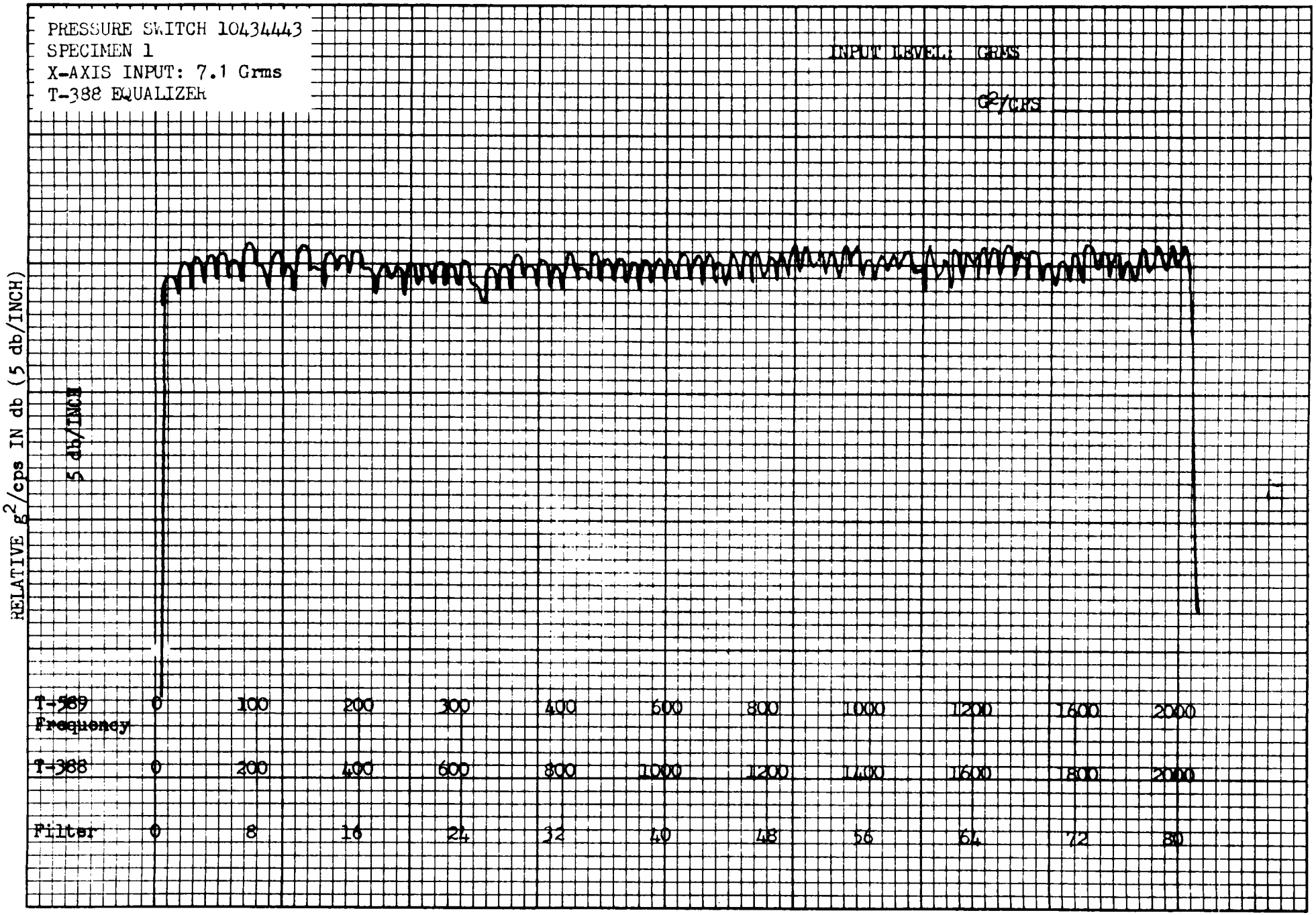


Figure 11-4. Typical Random Equalization Plot

SECTION XII

CYCLE TEST

12.1 TEST REQUIREMENTS

12.1.1 Test specimens 1, 2, and 3 shall be subjected to 5000 cycles of operation. A cycle shall consist of one actuation and one de-actuation of the specimen.

12.1.2 The contacts of each specimen shall have a 28 vdc, 3 ampere resistive load applied during the cycle test.

12.1.3 A functional test as prescribed in section IV shall be performed prior to the cycle test (if more than 72 hours has elapsed since the last functional test) and following each 1000 cycles of operation.

12.2 TEST PROCEDURE

12.2.1 The test setup was assembled as shown in figure 12-1 using the equipment listed in table 12-1.

12.2.2 The resistive loads were adjusted to limit the current through the specimen contacts to 3 amperes.

12.2.3 The repeat cycle timers were adjusted so that the specimens were actuated for 3 seconds and deactuated for 3 seconds during each cycle.

12.2.4 Pressure regulator 3 was adjusted to provide 110 psig actuation pressure to specimens 1 and 2.

12.2.5 Pressure regulator 4 was adjusted to provide 650 psig actuation pressure to specimen 3.

12.2.6 The test specimens were monitored for proper operation using event recorder 11.

12.2.7 A functional test was performed after each 1000 cycles of operation.

12.3 TEST RESULTS

12.3.1 The specimens actuated and deactuated during each cycle of operation.

12.3.2 The specimens operated within the specified limits during the functional tests performed after each 1000 cycles of operation.

12.3.3 During the pretest functional of specimen 2 and after 2000 cycles of operation, both indicator lamps (figure 4-2) were off intermittently between 79 and 84 psig. Occasionally, during pressurization, the actuation lamp would flicker on and off between 79 and 84 psig.

12.4 TEST DATA

12.4.1 Data recorded during the cycle test are presented in tables 12-2, 12-3, and 12-4.

Table 12-1. Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimens	Helicoid Gage	4231-1 4231-2	NA	Pressure Switch
2	Gaseous Nitrogen	NA	NA	NA	650 psi
3	Pressure Regulator	Grove	15LXH	NA	
4	Pressure Regulator	Grove	15LXH	NA	
5	Pressure Gage	Supergage	1800T	NA	0 to 160 psig ±1% FS Cal date 11-12-66
6	Pressure Gage	Heise	H35225	012448	0 to 1000 psig ±1% FS Cal date 11-12-66
7	Solenoid Valve	Marotta Valve Corp.	MV100	NA	3000 psi, NC
8	Solenoid Valve	Marotta Valve Corp.	MV100	NA	3000 psi, NC
9	Repeat Cycle Timers	Industrial Timer Corp.	ET-15S	NA	3 seconds each
10	Power Supply	Perkin Electronics	NA	63-293	28-vdc, 40-amp
11	Event Recorder	Techni-Rite Electronics	TR-120	010461	
12	Load Banks	CCSD	NA	NA	3-amp, 28-vdc
13	Ammeter	Simpson	NA	NA	0-to 10-ampere (built into load banks)

Table 12-2. Cycle Test Operating Pressures for Specimen 1

Number of Cycles	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Differential Pressure (psi)	Specified Differential Pressure (psi max.)
0	98	100 (±15)	5	30
1000	98	100 (±15)	5	30
2000	98	100 (±15)	5	30
3000	98	100 (±15)	6	30
4000	98	100 (±15)	5	30
5000	98	100 (±15)	6	30

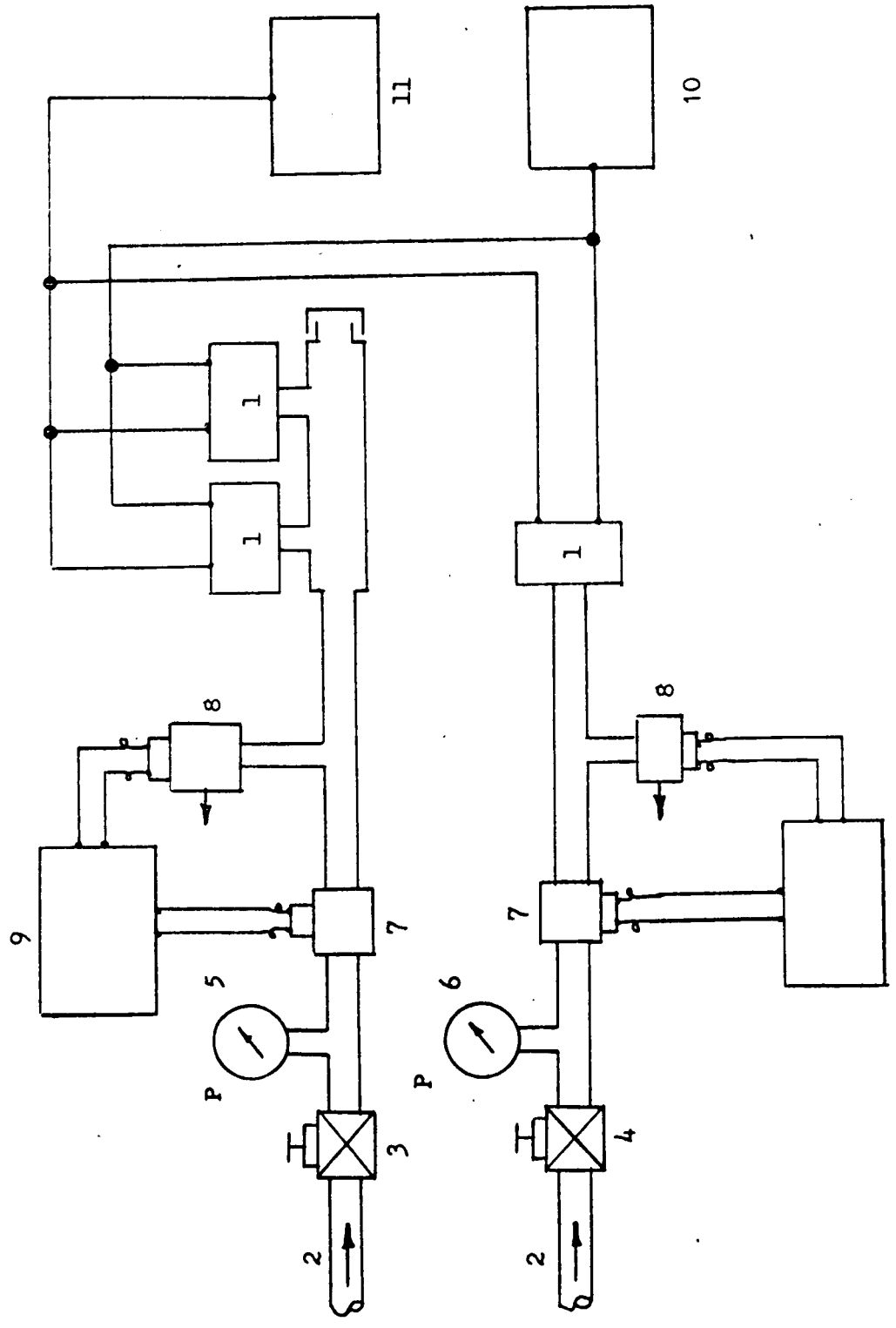
Table 12-3. Cycle Test Operating Pressures for Specimen 2

Number of Cycles	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Differential Pressure (psi)	Specified Differential Pressure (psi max.)
0	* 84	100 (±15)	5	30
1000	85	100 (±15)	5	30
2000	86	100 (±15)	6	30
3000	86	100 (±15)	6	30
4000	85	100 (±15)	5	30
5000	86	100 (±15)	6	30

* Out of tolerance (not readjusted after test)

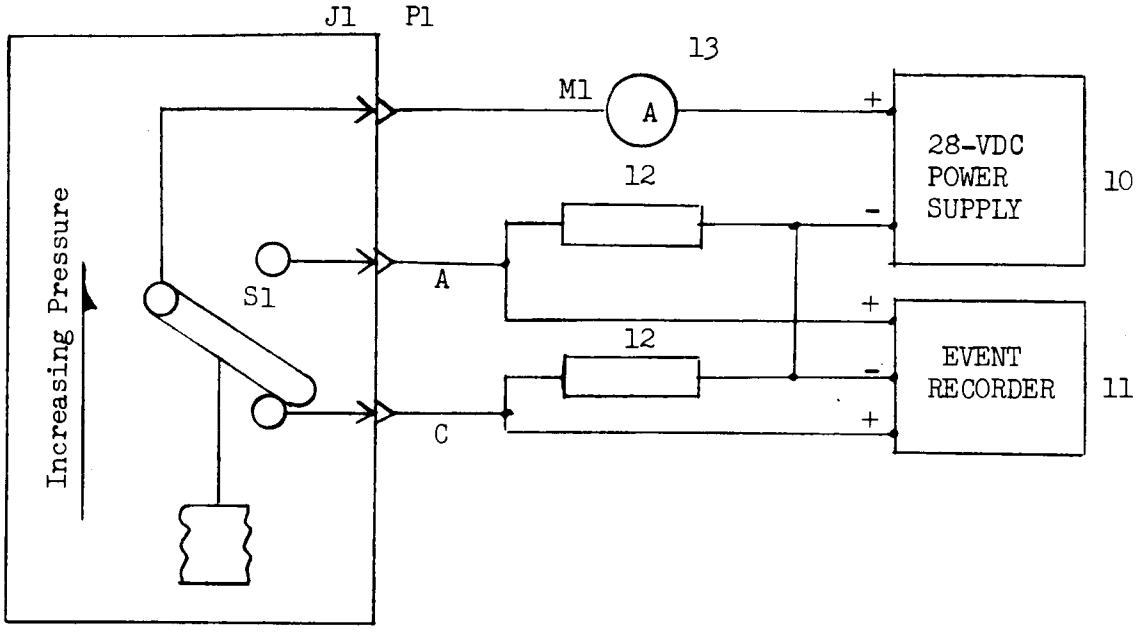
Table 12-4. Cycle Test Operating Pressures for Specimen 3

Number of Cycles	Average Actuation Pressure (psig)	Specified Actuation Pressure (psig)	Differential Pressure (psi)	Specified Differential Pressure (psi max.)
0	614	625 (±15)	52	55
1000	613	625 (±15)	50	55
2000	613	625 (±15)	50	55
3000	612	625 (±15)	51	55
4000	613	625 (±15)	50	55
5000	613	625 (±15)	51	55



Note: Refer to table 12-1 for item identification.

Figure 12-1. Cycle Test Schematic



Note: Refer to table 12-1 for item identification.

Figure 12-2. Typical Electrical Connection for Cycle Test Schematic

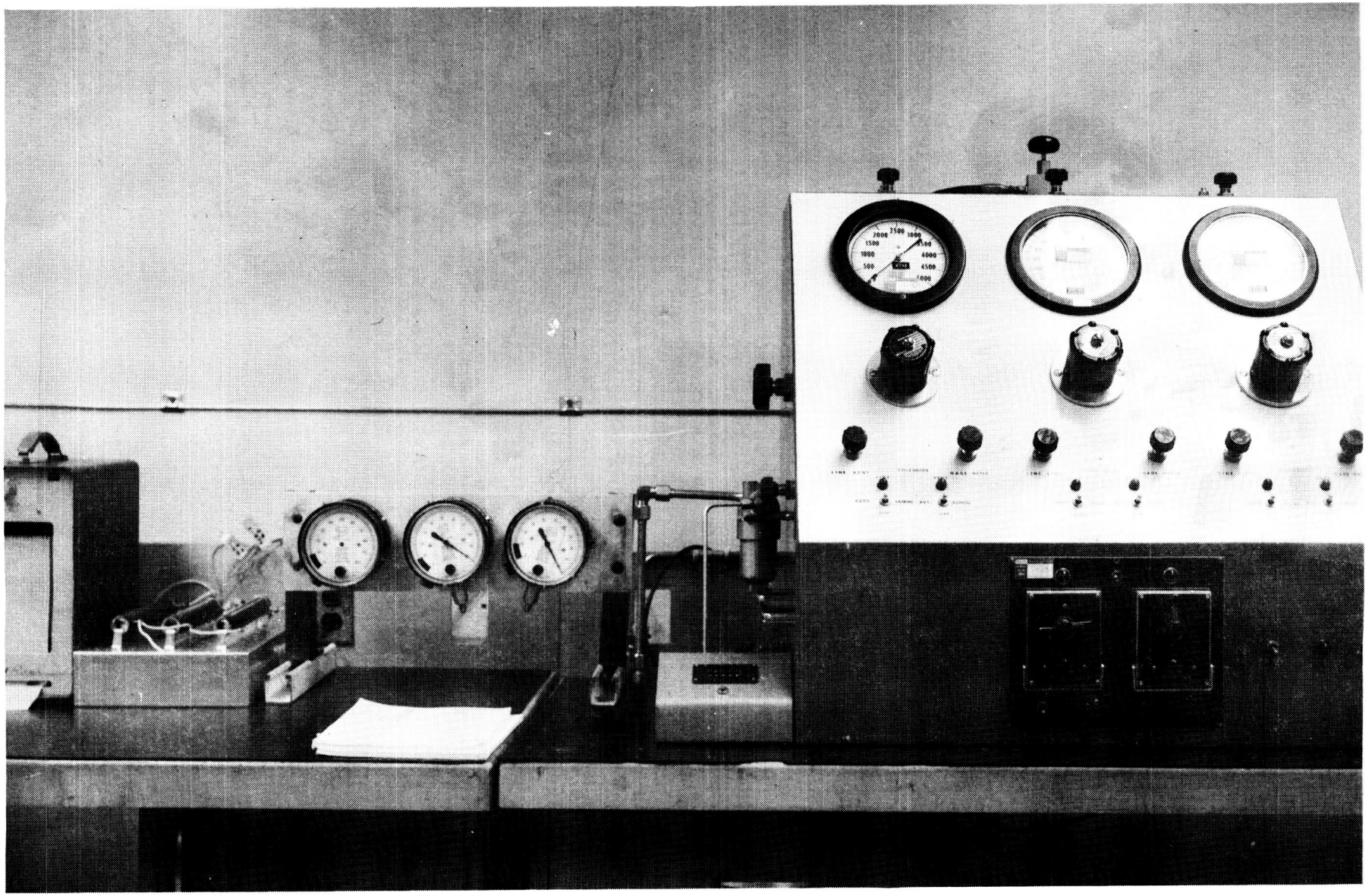


Figure 12-3. Cycle Test Setup

SECTION XIII

BURST PRESSURE TEST

13.1 TEST REQUIREMENTS

13.1.1 A burst pressure test shall be performed on specimens 1 and 3.

13.1.2 Test specimens 1 and 3 shall not burst when subjected to pressures of 425 psig and 1875 psig, respectively, for 5 minutes.

13.1.3 Hydraulic fluid MIL-H-5606 shall be used as the pressure medium.

13.2 TEST PROCEDURE

13.2.1 Each test specimen was placed in a burst chamber and connected to the hydraulic pressure system shown in figure 3-1 using the equipment listed in table 3-1.

13.2.2 The specified pressure was applied to the input port of each test specimen and was maintained for 5 minutes.

13.2.3 The specimens were inspected for evidence of cracking or rupture after the test.

13.3 TEST RESULTS

There was no leakage of the specimens and there was no evidence of internal or external damage.

APPROVAL

TEST REPORT

FOR

PRESSURE SWITCH

Helicoid Gage Division Part Numbers

4231-1 and 4231-2

NASA Drawing Numbers 10434443-6 and 10434443-18

SUBMITTED BY:

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